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LLNL Compliance Plan for TRUPACT-II Authorized Methods for Payload Control

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Lawrence Livermore National Laboratory

Compliance Plan for TRUPACT-II Authorized Methods for Payload Control

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Acronyms

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
C of C	Certificate of Compliance
CFR	Code of Federal Regulations
CH	contact handled
DOE	Department of Energy
DOT	Department of Transportation
FGE	fissile gram equivalent
FSP	facility-specific plan
HMPTS	Hazardous Materials Packaging and Transportation Safety (Committee)
HWM	Hazardous Waste Management (Division)
ICV	inner containment vessel
LLNL	Lawrence Livermore National Laboratory
MLU	mobile loading unit
MM	Materials Management (Division)
NCAR	Nonconformance and Corrective Action Report
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
OCA	outer containment assembly
PATCD	Payload Assembly Transportation Certification Document
PCTCD	Payload Container Transportation Certification Document
SARP	Safety Analysis Report for Packaging
SGS	segmented gamma scanner
SWB	standard waste box
TDOP	ten-drum overpack
TID	tamper indicating device
TRAMPAC	TRUPACT-II Authorized Methods for Payload Control
TRANSCOM	Transportation Tracking and Communications
TRU	transuranic
TRUCON code	TRUPACT-II Content Code
TRUCON document	TRUPACT-II Content Codes document
TRUPACT-II	Transuranic Package Transporter-II
VOC	volatile organic compound
WAC	waste acceptance criteria
WIPP	Waste Isolation Pilot Plant

1. Introduction

1.1 Purpose

The Transuranic Package Transporter-II (TRUPACT-II) is a Type B package used by the Department of Energy (DOE) waste generator and storage sites for the transportation of contact-handled (CH) transuranic (TRU) wastes. CH-TRU waste from the Lawrence Livermore National Laboratory (LLNL) is expected to be shipped in the TRUPACT-II to facilities like the Nevada Test Site (NTS) for off-site storage or to the Waste Isolation Pilot Plant (WIPP) for disposal. The purpose of this LLNL Compliance Plan for TRUPACT-II Authorized Methods for Payload Control (TRAMPAC) is to document CH-TRU waste management practices and procedures at LLNL in order to demonstrate compliance with the transportation requirements of the TRUPACT-II Safety Analysis Report for Packaging (SARP) (NuPac 1992). Appendix 1.3.7 of the TRUPACT-II SARP lists the restrictions on wastes to be transported in the TRUPACT-II and the allowable methods for determination and control for demonstrating compliance with these restrictions. This LLNL TRAMPAC identifies applicable LLNL procedures that demonstrate a one-to-one correspondence between each of the TRUPACT-II SARP requirements and the applicable procedures in place at LLNL that ensure compliance with these requirements. In addition, this LLNL TRAMPAC assures that all shipments of CH-TRU waste or other authorized contents from LLNL qualify for transport in the TRUPACT-II.

1.2 Compliance Requirements

Based on the TRUPACT-II SARP, the Nuclear Regulatory Commission (NRC) granted an original Certificate of Compliance (C of C) and subsequent amendments for the TRUPACT-II package (NRC 1994). The C of C is the highest-tier document governing the use of the TRUPACT-II and is the regulatory document that has been followed for the preparation of this document. The C of C sets forth the conditions under which the TRUPACT-II may be used for the shipment of CH-TRU waste. The TRUPACT-II SARP (NuPac 1992), referenced by the C of C, details the payload requirements that must be met in order for any CH-TRU waste to be shipped in the TRUPACT-II. Specifically, Appendix 1.3.7 of the TRUPACT-II SARP discusses authorized payload contents of the TRUPACT-II.

The compliance parameters set forth in Appendix 1.3.7 of the TRUPACT-II SARP include the following:

- Payload classification and assignment of shipping categories
- Physical form
- Chemical properties

- Chemical compatibility
- Gas distribution and pressure buildup
- Payload container and contents configuration
- Isotopic inventory and fissile content
- Decay heat
- Weight and center of gravity
- Radiation dose rate
- Payload assembly criteria.

1.3 Scope and Organization

Appendix 1.3.7 of the TRUPACT-II SARP (NuPac 1992) requires that each user of the TRUPACT-II document the methods used to comply with the TRUPACT-II payload requirements. This LLNL TRAMPAC describes methods in place at LLNL that are used to ensure compliance with the TRUPACT-II payload requirements and, therefore, fulfills this requirement for LLNL. This document also references the plans and procedures currently in place at LLNL that ensure compliance with these requirements.

The remaining chapters of this document, with the exception of Chapters 13, 14, and 15, are organized according to the TRUPACT-II payload parameters. Where appropriate, chapters contain three subsections: one that lists the specific requirements of the TRUPACT-II SARP (X.1), one that documents LLNL's method of compliance (X.2), and one that outlines LLNL's method of verification (X.3). These chapters parallel the sections in Appendix 1.3.7 of the TRUPACT-II SARP (NuPac 1992). Chapter 13 discusses quality assurance, and Chapter 14 provides a summary of the payload control procedures in place at LLNL. Chapter 15 lists the references used for this document, and Chapter 16 provides a glossary of terms used in this document. In addition, Appendix A includes copies of the forms used by LLNL to document compliance with various requirements outlined in this document.

2. Payload Classification

2.1 Requirements

2.1.1 Definition of Shipping Categories

As outlined in the TRUPACT-II SARP, all waste containers to be transported in the TRUPACT-II must be assigned a specific "shipping category," based on the physical and chemical characteristics of the waste and the packaging configuration used (NuPac 1992). Assigning a waste to the appropriate shipping category ensures that the waste is shipped under safe transportation conditions that meet the requirements of the TRUPACT-II SARP.

The shipping category is denoted by a series of alphanumeric characters that indicate the type of waste, type of container used to package the waste, and the number and type of confinement layers present in the payload container. The shipping category is in the form $N.n_1Xn_2$

where

N = A Roman numeral (I to IV) that describes the physical form of the waste and is termed the "Waste Type" (see Table 2-1).

n_1 = A number (1, 2, or 3) denoting cases where further division of the Waste Type has been made based on the gas-generating potential of the waste (these subcategories of the Waste Type are termed "Waste Material Types") (see Table 2-1).

X = A capital letter (A, B, C, or D) that designates the payload container and, if applicable, the overpacking configuration (see Table 2-2).

n_2 = An alpha or numeric character that denotes the number of bag layers or type of containment of the waste. The number of layers of plastic is indicated by a number 0 through 6. The letter M is used when the waste is placed directly in a metal can as the innermost layer of confinement.

Occasionally a T (which stands for "test category") is placed at the end of a shipping category to indicate a shipping category that cannot be shipped without first performing a test to verify the actual gas generation rate of the container. The required testing is described in Appendix 1.3.7 (Attachment 2.0) of the TRUPACT-II

SARP. All other shipping categories are referred to as analytical shipping categories.

Shipping category III.1A3 is an example of a current LLNL shipping category, which denotes a solid organic waste packaged with a maximum of three layers of confinement inside of a drum. Further details on the definition of shipping categories are provided in the TRUPACT-II SARP (NuPac 1992).

Table 2-1. TRU Waste Types and Corresponding Waste Material Types[a]

Waste Type	Waste Material Type	Description
I		SOLIDIFIED AQUEOUS OR HOMOGENEOUS INORGANIC SOLIDS
	I.1	Solidified inorganic liquids
	I.2	Soils or sludges
	I.3	Concreted inorganics
II		SOLID INORGANICS
	II.1	Solid inorganics in plastic packaging
	II.2	Solid inorganics in metal can
III	III.1	SOLID ORGANICS
IV	IV.1	SOLIDIFIED ORGANICS

[a]The information in this table was derived from the TRUPACT-II SARP (NuPac 1992).

Table 2-2 Payload Container and Configuration Definitions[a]

Primary Payload Container	Overpacked Containers and Configuration (if applicable)	TRUPACT-II Payload Configuration	Shipping Category Alpha Designator
55-gallon drum	None	2 seven packs (14 drums) per TRUPACT-II	A
Standard waste box (SWB)	Up to four drums overpacked in one SWB	2 SWBs per TRUPACT-II	B
SWB	None	2 SWBs per TRUPACT-II	C
SWB	One experimental bin per SWB	2 SWBs per TRUPACT-II	D

[a]The information for this table was derived from the TRUPACT-II SARP (NuPac 1992).

2.1.2 Relation of Shipping Categories to TRUCON Codes

Each waste form at a given site is also characterized by its contents and packaging method and has been assigned a TRUPACT-II content code (a TRUCON code). The TRUPACT-II Content Codes document (the TRUCON document) (DOE 1992), which is referenced by the C of C for the TRUPACT-II, presents a description of each TRU waste form at each site and is used to establish a TRUCON code and a corresponding shipping category for each waste form. Only CH-TRU waste forms described under a content code in the TRUCON document can be transported in the TRUPACT-II.

TRUCON codes fully characterize the waste and provide descriptions for compliance with the following parameters:

- Content code description
- Storage site (if applicable)
- Generating site

- Waste description
- Generating source(s)
- Waste form
- Waste packaging
- Assay
- Free liquids
- Explosives/compressed gases
- Pyrophorics
- Corrosives
- Chemical compatibility
- Payload container venting and aspiration
- Additional criteria
- Shipping category
- Analytical category (maximum allowable wattage)
- Test category (maximum allowable wattage)
- Correlation table for internal site waste codes.

The TRUCON codes for LLNL are in the form of LL $1n_1X$ or LL $2n_1X$

where

LL = Identifies the waste as being from LLNL.

1 or 2 = Identifies the age or certifiability of the waste. The "100" series denotes newly generated waste that was precertified or waste that has been generated under a documented certification program and is awaiting shipment to NTS, to WIPP, or to another storage site. The "200" series is used for retrievably stored waste that was not precertified or waste that was generated prior to a documented certification program and is in storage. LLNL does not have any 200 series (retrievably stored) waste forms listed in the TRUCON document.

n_1 = A number from 11 to 29 that denotes different TRUCON codes based on the physical and chemical form of the waste.

X = A letter that denotes the TRUCON code subcategory. The letters A to E are used to further differentiate the waste form in terms of varying packaging configurations.

An example of a current LLNL TRUCON code is LL 116A, which denotes newly generated glove box waste at LLNL that is identified as TRU combustible waste (and has a shipping category of III.1A3).

2.1.3 LLNL Waste Forms Authorized for Shipment in the TRUPACT-II

LLNL is a multiprogram laboratory operated by the University of California for the DOE. Major DOE programs conducted by LLNL include weapons activities, inertial confinement fusion, verification and control technology, magnetic fusion energy, commercial nuclear waste, isotope separation technology, biomedical and environmental research, fossil energy, energy storage systems, and basic energy sciences. LLNL also performs research on a variety of projects for other governmental agencies and nonprofit organizations. All TRU waste at LLNL is currently generated from defense-related programs.

TRU waste is segregated at LLNL from non-TRU waste according to DOE Order 5820.2A, "Radioactive Waste Management" (DOE 1988). By volume, approximately 95% of LLNL's TRU waste is contaminated primarily with plutonium isotopes, including Pu-238, Pu-239, Pu-240, Pu-241, and Pu-242. The typical curie loading for a drum of this type of waste is 1 alpha Ci. The remaining 5% by volume of LLNL's TRU waste is contaminated primarily with Am-241, Np-237, Cm-244, Cm-248, Cf-250, Cf-252, and possibly co-contaminated with fission products. Because of a higher non-Pu-239 content, this category constitutes about 60% by activity of LLNL's TRU waste. The typical curie loading for a drum of this type of waste is 6 alpha Ci.

LLNL generates between 10 and 20 m^3 of TRU waste per year. Nearly all TRU waste from LLNL is generated from the Plutonium Facility (Building 332) and from the Heavy Element Facility (Building 251). Less than 1 m^3 per year is generated by other LLNL organizations, including Materials Management (MM), Hazards Control Department, and other generators. The Waste Certification Program at LLNL is responsible for ensuring waste certification. The Hazardous Waste Management (HWM) Division at LLNL is responsible for ensuring waste shipment.

Table 2-3 presents the correlation between the TRUCON code, the site-specific LLNL waste form number, the waste form description, and the shipping category for the different TRU waste forms generated at LLNL. These are the LLNL waste forms currently included in the TRUCON document and authorized for shipment in the TRUPACT-II.

Table 2-3. LLNL Waste Forms Authorized for Shipment in the TRUPACT-II

TRUCON Code[a]	LLNL Waste Form No.[b]	Waste Form Description[b]	Shipping Category[a]
LL 111A	002	Solidified Liquid Waste (Aqueous Only)	I.1A0 I.1B0
LL 113A	002	Solidified Liquid Waste (Oils or Solvents Present)	IV.1A3T IV.1B3T
LL 116A	001	Glove Box Waste	III.1A3 III.1B3
LL 124A	004	Waste Salt Blocks (Organics Absent)	II.2AM II.2BM
LL 124B	004	Waste Salt Blocks (Trace Organics Present)	II.1A3 II.1B3
LL 125A	003	Metal Scrap Waste	III.1A3 III.1C2

[a]The TRUCON code and shipping category were obtained from the TRUCON document (DOE 1992).

[b]The LLNL waste form numbers and waste form descriptions were obtained from the Lawrence Livermore National Laboratory Transuranic Waste Program Certification and Quality Assurance Plan (LLNL 1994a).

2.1.4 Payload Classification Requirements

As stated previously, only waste with an approved TRUCON code can be shipped in the TRUPACT-II. Each payload container (i.e., a 55-gallon drum or a standard waste box [SWB]) must be assigned to a shipping category and a TRUCON code, with the payload container contents and packaging configuration consistent with the TRUCON code and shipping category descriptions.

2.2 Method of Compliance

As noted in Section 2.1.2, all of the CH-TRU waste at LLNL to be shipped in the TRUPACT-II is newly generated waste, meaning that it was generated under a formal waste certification program. CH-TRU waste from LLNL planned for shipment in the TRUPACT-II is waste generated during or after 1986 under the LLNL certification program. A small number of TRU waste containers generated prior to 1986 are in retrievable storage at LLNL. These containers will be repackaged or reprocessed prior to transportation in the TRUPACT-II.

The TRU Waste Certification Program at LLNL is governed by the "Lawrence Livermore National Laboratory Transuranic Waste Program Certification and Quality Assurance Plan," (document No. M-078-121) (LLNL 1994a). This document is the highest-tier document that applies to all generators of TRU waste at LLNL and to all activities associated with TRU waste certification. The TRU waste generators (the Plutonium Facility and the Heavy Element Facility) operate using specific procedures that are written to be in compliance with the Waste Certification Program. Elements of the LLNL Waste Certification Program that apply to the TRUPACT-II payload requirements are described in the remainder of this document. Wherever applicable, reference is made to specific LLNL procedures (in italics) that ensure compliance with the TRUPACT-II requirements.

Since January 1993, a 100% verification program has been instituted at LLNL as part of the Waste Certification Program. This verification program is described in more detail in the remainder of this section and in Section 2.3. For waste generated since January 1993, records and documentation and independent verification are the primary mechanisms of waste certification. Waste generated prior to January 1993 was also generated under a formal certification program but did not undergo 100% independent verification. For this waste, records and documentation will be supplemented with process knowledge and other compliance methods, such as real-time radiography and/or limited sampling as part of the Waste Certification Program.

This section describes documented certification procedures currently in place at LLNL for ensuring compliance with the payload classification and certification requirements. These procedures track the generation of each waste form and provide a documented trail for the waste packaged in each individual payload container. There are five primary data collection documents used to establish the certifiability of TRU waste at LLNL. These are:

- LLNL TRU Waste Parcel Card, which is unique to each parcel of waste generated

- LLNL TRU Waste Disposal Requisition, which is unique to each waste container
- LLNL TRU Waste Container Inspection Card, which is unique to each waste container
- LLNL TRU Waste Container Final Inspection Card, which is unique to each waste container
- LLNL TRU Waste Radiological Survey Card, which is unique to each waste container

All of the data collection cards are traceable by means of a unique serial identification number assigned to the waste and the container they describe. The tracking system in place for use of these cards for TRU waste generation at LLNL is described below. Copies of each of these documents are provided in Appendix A.

2.2.1 LLNL TRU Waste Parcel Card

The LLNL TRU Waste Parcel Card is filled out for every parcel of waste generated from each of the facilities at LLNL. One or more of these parcels is placed in a final waste container. The LLNL TRU Waste Parcel Card is the primary document used in determining the certifiability of the final waste container. Waste parcel contents are documented on this form in terms of the LLNL waste form number, and the waste parcel is identified with the LLNL TRU Waste Parcel Card number. Key information documented on the LLNL TRU Waste Parcel Card includes the date of generation, waste form identification and physical description and inventory of the waste, radioactivity characterization, and verification of the absence of prohibited items. Upon verification of the waste parcel (see Section 2.3), the serial number of the container into which the parcel is placed is entered on the LLNL TRU Waste Parcel Card. All LLNL TRU Waste Parcel Cards are appended to the LLNL TRU Waste Disposal Requisition (see Section 2.2.2) for the container in which the parcel is placed (*Appendix H, "Transuranic Waste Handling and Packaging Procedures," of the Building 332 Facility-Specific Plan* [FSP] and *Procedure TIP-HEF-008, "Waste Acceptance Criteria [WAC] Procedures"*). Specific instructions for completing this card are provided in *Procedure WCP-20, "Management of TRU Waste by TRU Waste Generators."*

2.2.2 LLNL TRU Waste Disposal Requisition

The LLNL TRU Waste Disposal Requisition is the second document used in determining the certifiability of the final waste container. Data from each of the LLNL TRU Waste Parcel Cards are compiled and entered on this form, thereby documenting the complete contents of the waste container. Radionuclide information (curies and grams) and the waste form information are also logged on the LLNL TRU Waste Disposal Requisition for each waste container. The closure of the waste container is also formally documented on this form by the person performing the operation. Specific instructions for completing this card are provided in *Procedure WCP-20.*

2.2.3 LLNL TRU Waste Container Inspection Card

The LLNL TRU Waste Container Inspection Card documents visual inspection of the empty waste containers procured from the vendors, prior to the placement of waste in a container. The visual inspection documented on the LLNL TRU Waste Container Inspection Card is first performed by the HWM Division, which is responsible for the procurement of the waste containers from the vendor. The HWM Division then delivers acceptable waste containers to the generators upon request, and the generators also complete an LLNL TRU Waste Container Inspection Card to document receipt of acceptable waste containers from the HWM Division. This process is described in *HWM Procedure No. 202, "TRU Container Inspection and Control,"* for the HWM Division and in *Procedure TIP-HEF-009, "TRU Waste Container Inspection Procedure,"* and *Appendix H of the Building 332 FSP* for the waste generators.

Inspection of the empty waste containers documented on the LLNL TRU Waste Container Inspection Card includes verification of the absence of any defects (including holes and significant rust), verification of the presence of filter vents (one for drums and two for SWBs), and verification of a 0.3-inch or greater vent hole in the drum liner lids. The use of this card for ensuring compliance with the container requirements is described further in Chapter 7. Specific instructions for completing this card are provided in *Procedure WCP-20.*

2.2.4 LLNL TRU Waste Container Final Inspection Card

The LLNL TRU Waste Container Final Inspection Card documents visual examination of a waste container by the HWM Division after the waste is placed in the container by the generator and the container has been received for storage. The LLNL TRU Waste Container Final Inspection Card documents the acceptable condition of the final waste container prior to shipment. The use of this card for ensuring compliance with the container requirements is described further in Chapter 7. The final contents of the waste containers are controlled by the use of

tamper indicating devices (TIDs) on the containers. As discussed in Chapter 8, assay measurements are performed on waste containers only after the TIDs are affixed. Specific instructions for completing the LLNL TRU Waste Container Final Inspection Card are provided in *Procedure WCP-21, "Certification of Transuranic Waste Packages."*

2.2.5 LLNL TRU Waste Radiological Survey Card

The LLNL TRU Waste Radiological Survey Card contains information on the total weight of the waste package, surface contamination, dose measurement, and instrument performance data. It is filled out by the HWM Division after receipt of the waste package for storage. The use of this card for ensuring compliance with the weight and dose rate requirements is discussed in Chapters 10 and 11. Specific instructions for completing this card are provided in *Procedure WCP-21.*

2.3 Method of Verification

As described earlier, 100% verification applies to all currently generated TRU waste at LLNL. The contents of the waste parcels are verified to assure compliance with all requirements. Verification activities are performed by TRU waste parcel verifiers who are trained and have taken the course EP 0021, "TRU Waste Certification Program." The Facility Manager maintains a list of approved verifiers. Only those individuals on the current list may verify TRU waste parcels and containers. The waste parcel verifiers act as an independent check on the waste generators in ensuring compliance with the waste certification requirements.

An authorized waste parcel verifier performs the following activities to verify that each waste parcel is in compliance with the requirements discussed in Section 2.1 and applicable waste certification requirements (*Appendix H, Building 332 FSP* and *Procedure TIP-HEF-008*):

- Visually inspects waste items before packaging into parcels or performs destructive examination of waste parcels, including a check for the absence of prohibited items (see Section 3.1)

- Surveys waste generator packaging operations, such as waste consolidation, loading of waste into a glove box bag, and bag-out

- Completes and checks verification records:

  – Validates entries made by waste generators on the LLNL TRU Waste Parcel Card after waste packaging by completing the "Verification" section of the LLNL TRU Waste Parcel Card, which is inserted into the sleeve on the container

  - Verifies that the unique serial number from the LLNL TRU Waste Parcel Card is marked on each waste parcel before placement into 55-gallon drum

- Surveys the logging of work data into the TRU Waste Log Book or database.

Additional responsibilities of the waste parcel verifiers are outlined in Section 13.1.1.3.

In addition, for Building 332, a Room Responsible Person, delegated by the Facility Manager, ensures that verification requirements are implemented and that a record of verification activities is maintained for each laboratory. The following information is retained in a laboratory notebook or database by the Room Responsible Person for all TRU-waste parcels:

- Date of waste bag-out
- Name of waste generator
- Name of verifier
- Identification number of waste parcel (i.e., the number of the LLNL TRU Waste Parcel Card)
- Serial number of the container in which the waste parcel is placed
- Container type (e.g., SWB or Type 17C or UN 1A2 drum).

Once the contents of a waste container are documented and verified, the waste generator forwards the documentation package (consisting of the three documents discussed in Sections 2.2.1 through 2.2.3) to the Waste Certification Engineer for review. Prior to performing the documentation review, the Waste Certification Engineer obtains a TRU Waste Package Certification Checklist and completes the "container description" section of this checklist. A copy of the TRU Waste Package Certification Checklist is included in Appendix A. The Waste Certification Engineer and an HWM Chemist review the documents for approval to send the container for storage. If the documentation package is acceptable, the HWM Field Technician assists in closing the waste container according to facility procedures and in placing TIDs on the containers (*Appendix H of the Building 332 FSP* and *Procedure TIP-HEF-011, "DOT 17-C or UN 1A2 Drum Closure Procedure"*). The closing of the container is performed in the presence of the Waste Certification Engineer.

The waste container is then assayed (with the results documented on the Waste Disposal Requisition) and sent to the HWM Division for proper storage. As discussed in Sections 2.2.4 and 2.2.5, the container is inspected upon receipt at HWM storage, and the LLNL TRU Waste Container Final Inspection Card and the LLNL TRU Waste Radiological Survey Card are generated for the container. The Waste Certification Engineer reviews these documents (in addition to the three discussed in Sections 2.2.1 through 2.2.3) and completes the TRU Waste Certification Checklist documenting review and approval of all five cards. The LLNL TRU Waste Container Final Inspection Card and the LLNL TRU Waste Radiological Survey Card are added to the documentation package for the container.

Additional responsibilities of the Waste Certification Engineer are outlined in Section 13.1.2.5.

The TRU waste certification process at LLNL described above assures assignment of waste containers to the proper shipping category and TRUCON code, and provides traceability for the contents of each container. As noted earlier, the use of the certification cards in demonstrating compliance with specific payload requirements is described under each parameter in Chapters 3 through 13.

3. Physical Form

3.1 Requirements

The physical form of waste constituting the TRUPACT-II payload is restricted to solid or solidified materials. Liquid waste is prohibited, except for residual amounts in well-drained containers. The total volume of residual liquid in a payload container is restricted to less than 1 volume percent.

Sharp or heavy objects must be blocked, braced, or suitably packaged to provide puncture protection equivalent to Type A packaging requirements specified by the Department of Transportation (DOT).

Sealed containers are prohibited from being included as part of the waste, except for containers that are 4 liters or less in size. These do not include plastic bags used to package the waste. Containers greater than 4 liters in size may be present only if there is verifiable evidence that they are not sealed (e.g., visible absence of a cap or presence of a puncture in the container). In addition, pressurized containers are prohibited.

3.2 Method of Compliance

This section outlines LLNL's method of compliance with the physical form requirements specified in Section 3.1.

The four types of waste produced at LLNL include the following:

- Waste Form No. 1, glove box waste, which includes essentially untreated solid materials, such as wiping tissues, paper, plastic, chemistry glassware, ceramics, and metals

- Waste Form No. 2, solidified aqueous or liquid waste, which is free of liquids, powder, ashes, compressed gases, and combustible materials

- Waste Form No. 3, metal scrap waste, which is composed primarily of objects that, because of physical size, cannot be packaged in a 55-gallon drum (e.g., decommissioned glove boxes, hoods, and large pieces of equipment)

- Waste Form No. 4, waste salt blocks, which are free of liquids, sludges, compressed gases, pyrophoric materials, and explosives.

Compliance with the physical form requirements is determined by visual inspection and waste generation procedures. No CH-TRU waste forms other than solid or solidified materials are generated at LLNL for transportation off site. Prohibited

physical waste forms are removed from the waste by the waste generator prior to packaging (LLNL 1994a) and are segregated. Specific procedures describing compliance with each of the physical waste form requirements are listed in Table 3-1.

3.3 Method of Verification

The LLNL TRU Waste Parcel Card requires the waste generator to document the absence of prohibited items, such as free liquids and compressed gases. This action is independently checked when a package is verified by the waste parcel verifier. The waste generation procedures detail the specific actions needed for compliance with the physical form requirements, as detailed in Table 3-1. Compliance with these procedures is periodically verified by audits and surveillances, as described in Chapter 13. For wastes generated since January 1993, independent verifications by the waste parcel verifiers have been performed on 100% of the waste. For wastes generated prior to January 1993, the Waste Certification Program at LLNL and the applicable procedures ensure compliance with the physical form requirements. Records and documentation show that approximately 50% of these wastes were also independently verified for proper certification. LLNL is currently instituting a detailed process knowledge study to document the certification status of these wastes. Other waste verifications, such as real-time radiography and sampling programs, are expected to be utilized at LLNL as part of the TRU Waste Characterization Program for the WIPP Compliance Program. Information from these programs will also be used to assess compliance with the TRUPACT-II requirements. A Quality Assurance Project Plan (LLNL 1994b) is being developed at LLNL for implementation of the TRU Waste Characterization Program.

Table 3-1. Compliance with Physical Form Restrictions for LLNL[a]

LLNL Waste Form No. (Waste Form Name)	Compliance Method	Applicable LLNL Procedure
	FREE LIQUIDS	
Waste Form No. 1 (Glove Box Waste)	None. Does not contain any liquids by definition	M-078-121
Waste Form No. 2 (Solidified Liquid Waste)	Water-based liquids are solidified with portland cement or Aquaset®; oil-based liquids and solvents are solidified with Envirostone® or Petroset®. Containers and bottles are drained prior to disposal.	M-078-121, MM-V-41 (Building 332), and TIP-HEF-007 (Building 251)
	The container is tipped to see if liquids are still present 24 hours after solidification. If so, the liquids are poured into another bottle and the solidification procedure is repeated.	TIP-HEF-007 (Building 251)
	The paint filter test is used for waste solidified with Aquaset® and Petroset®.	MM-V-41 (Building 332)
Waste Form No. 3 (Metal Scrap Waste)	Free liquids are removed and disposed of with a liquid waste stream. Bottles, cans, and similar containers are removed.	M-078-121
Waste Form No. 4 (Waste Salt Blocks)	None. Does not contain any liquids by definition.	M-078-121
	SHARP OR HEAVY OBJECTS	
Waste Form No. 1 (Glove Box Waste)	Glassware; razor blades; or other small, sharp objects are placed in metal can with secured lid. Sharp corners or protruding parts of large and/or heavy items are covered with protective padding (e.g., aluminum foil and plastic) and taped.	Appendix H, Building 332 FSP
Waste Form No. 2 (Solidified Liquid Waste)	None. Solidified liquids have no sharp or heavy objects.	M-078-121

Refer to footnote at end of table.

Table 3-1. Compliance with Physical Form Restrictions for LLNL (continued)

LLNL Waste Form No. (Waste Form Name)	Compliance Method	Applicable LLNL Procedure
SHARP OR HEAVY OBJECTS (Continued)		
Waste Form No. 3 (Metal Scrap Waste)	Any equipment remaining in a glove box is secured to one of the inner surfaces of the glove box to prevent movement.	Appendix H, Building 332 FSP
	Heavy articles, articles with sharp corners, or any material that results in highly localized forces are secured. Foam, tents, or other available materials are used to pack the container so that the glove box will not move if the container is dropped.	Appendix H, Building 332 FSP
Waste Form No. 4 (Waste Salt Blocks)	None. Salt-block waste contains no sharp or heavy objects.	M-078-121
All Waste Forms	Waste containers are inspected for damage both before and after being filled with waste.	WCP-20 and WCP-21
SEALED CONTAINERS GREATER THAN 4 LITERS IN SIZE		
Waste Form No. 1 (Glove Box Waste)	Small items are packed in ice cream cartons or in spent plastic bags.	Appendix H, Building 332 FSP TIP-HEF-008 (Building 251)
Waste Form No. 2 (Solidified Liquid Waste)	None. Solidified liquid waste is not packed in sealed containers.	M-078-121
Waste Form No. 3 (Metal Scrap Waste)	None. Contaminated glove boxes and other equipment items are too large to be packed in small containers.	M-078-121
Waste Form No. 4 (Waste Salt Blocks)	When salt blocks (inorganic) are placed in metal cans, the can is not sealed if the size of the can is greater than 4 liters.	Appendix H, Building 332 FSP M-078-121

Refer to footnote at end of table.

Table 3-1. Compliance with Physical Form Restrictions for LLNL (continued)

LLNL Waste Form No. (Waste Form Name)	Compliance Method	Applicable LLNL Procedure
PRESSURIZED CONTAINERS		
Waste Form No. 1 (Glove Box Waste)	Aerosol cans are emptied, then punctured and crushed.	Appendix H, Building 332 FSP
	Aerosol cans are punctured.	TIP-HEF-008 (Building 251)
Waste Form No. 2 (Solidified Liquid Waste)	None. No pressurized containers are present in solidified liquid waste.	M-078-121
Waste Form No. 3 (Metal Scrap Waste)	Aerosol cans are emptied, then punctured and crushed.	Appendix H, Building 332 FSP
	Aerosol cans are punctured.	TIP-HEF-008 (Building 251)
Waste Form No. 4 (Waste Salt Blocks)	None. No pressurized containers are present in salt-block waste.	M-078-121

[a]In addition to the procedures listed, the LLNL TRU Waste Parcel Card documents the absence of prohibited items and waste compliance with the physical form requirements.

4. Chemical Form and Chemical Properties

4.1 Requirements

The chemical properties of the waste are determined by the chemical constituents allowed in a given waste type (e.g., solidified aqueous or homogeneous inorganic solids are Waste Type I). These constituents are restricted so that all payload containers are safe for handling and transport. Specific requirements on the chemical form of the waste are described below.

4.1.1 Prohibited Chemical Constituents

Three types of chemical constituents are prohibited from a TRUPACT-II payload, i.e., explosives, nonradioactive pyrophorics, and corrosives, as defined in the TRUPACT-II SARP (NuPac 1992).

An explosive is defined as: "Any chemical compound, mixture, or devise, the primary or common purpose of which is to function by explosion (i.e., with substantial instantaneous release of gas and heat)." Examples of explosives are ammunition, dynamite, black powder, detonators, nitroglycerine, urea nitrate, and picric acid.

A pyrophoric is defined as: "A flammable solid which, under transport conditions, might cause fires through friction or retained heat, or, which can be ignited readily, and when ignited, burns vigorously and persistently so as to create a serious transportation hazard." This includes spontaneously combustible materials, water reactive materials, and oxidizers. Pyrophoric radioactive materials may be present only in a small residual amount (i.e., less than 1 weight percent) in payload containers.

A corrosive is defined as an aqueous material that has a pH less than 2 or more than 12.5. Acids and bases that are potentially corrosive must be neutralized and rendered noncorrosive prior to being a part of the waste.

As discussed in Section 4.2, the physical form of the waste and waste generating procedures at LLNL ensure that the waste does not contain these prohibited chemical constituents.

4.1.2 Restricted Chemical Constituents

Pyrophoric radionuclides and potentially flammable volatile organic compounds (VOC) are restricted to specified levels for the TRUPACT-II payload, as follows:

- Pyrophoric radionuclides may be present only in small residual amounts (less than 1 weight percent).

- The total amount of potentially flammable VOCs that can be present in the headspace of a payload container is restricted to 500 ppm.

All LLNL TRUCON codes are grouped into waste types and further divided into waste material types, based on their gas generation potential (as discussed in Appendix 3.6.7 of the TRUPACT-II SARP). In order to conform to the classification into these waste material types, the chemicals and materials within a given waste material type are further restricted. These restrictions apply to all materials that are present in the waste in amounts greater than 1 weight percent.

The materials that are allowed within each waste type in order to conform with the bounding G values (which quantify the gas-generation potential of the waste) are listed in Tables 4 through 8 of Appendix 3.6.7 of the TRUPACT-II SARP for Waste Types I, II, and III. At the present time, an effective G value cannot be assigned to Waste Type IV, and this waste type has been assigned to the test category. It can be qualified for shipment only by testing each individual payload container. The test procedures and controls for test category waste are discussed in Attachment 2.0 of Appendix 1.3.7 of the TRUPACT-II SARP.

4.2 Method of Compliance

Compliance with chemical form and chemical property restrictions is demonstrated during the certification process as discussed below. The absence of prohibited materials and compliance with the limits on restricted chemicals are indicated by the waste generator on the LLNL TRU Waste Parcel Card for each parcel of waste generated.

4.2.1 Control of Explosives and Compressed Gases

By facility policy, explosives and compressed gases are not added to any waste package. Chemicals such as oxidizers capable of forming explosive mixtures under some conditions are prohibited from the waste (LLNL 1994a). As indicated in Table 3-1, aerosol cans are emptied and then punctured. The controls in place for ensuring the absence of these prohibited items are discussed in LLNL *Procedure TIP-HEF-008* and in *Appendix H of the Building 332 FSP*.

4.2.2 Control of Pyrophoric Materials

Waste generation procedures ensure that no pyrophoric materials can be present in the waste. Any potentially pyrophoric materials, other than radionuclides, are mixed with chemically stable material (e.g., cement, Envirostone®, Aquaset®, or

Petroset®) or processed to remove their hazardous properties. Pyrophoric radioactive forms (e.g., metal turnings and saw fines) are packaged in appropriate metal containers under an inert atmosphere and transferred to the Recovery Laboratory for processing or oxidation. Pyrophoric waste that is TRU-contaminated is collected and transferred to the Recovery Laboratory for stabilization and disposal. Once stabilized, these materials are considered nonpyrophoric and can be disposed of as TRU waste (*Appendix H of the Building 332 FSP* and *Procedure TIP-HEF-008*).

4.2.3 Control of Corrosives

Any TRU waste containing corrosive liquids is sent to the Recovery Laboratory for neutralization. The neutralized liquids are then either adsorbed by a material such as vermiculite or mixed with cement to form a monolith. None of the LLNL TRU waste forms contain any corrosives in their final form (DOE 1992, *Appendix H of the Building 332 FSP*, and *Procedure TIP-HEF-008*). No aqueous or liquid wastes are generated for shipment in the TRUPACT-II, as discussed in Chapter 3.

4.2.4 Control of Potentially Flammable VOCs

As mentioned previously, the total concentration of potentially flammable VOCs is limited to 500 ppm in the headspace of a payload container. Process knowledge at LLNL indicates that, for Waste Types I, II, and III, only a few flammable VOCs can potentially be present. These VOCs are expected to be present only in trace amounts. Additional compliance information will be gained on flammable VOC concentrations in headspace gases during the TRU Waste Characterization Program (LLNL 1994b) to be implemented at LLNL for the WIPP Compliance Program. A statistically based sampling program will eventually be developed to sample representative containers to provide assurance within a predetermined confidence interval that wastes are in compliance with the 500 ppm flammable VOC limit.

At the present time, payload containers belonging to Waste Type IV (solidified organics, TRUCON code LL 113A) belong to the test category and cannot be shipped unless individually tested for gas generation potential. The TRUPACT-II Gas Generation Test Program (NuPac 1992) establishes the criteria and data quality objectives for this testing and will be implemented at LLNL for the shipment of waste belonging to Waste Type IV.

4.2.5 Control of Chemical Composition of Waste Material Types

The TRUPACT-II Chemical Lists document (Attachment B-1 of the TRUPACT-II SARP) includes lists of the materials and chemicals expected to be present in the LLNL waste forms by content code and in terms of amount—either trace (<1% by weight), minor (1 to 10% by weight), or dominant (>10% by weight). An evaluation of these lists indicates that all of the LLNL waste forms comply with the applicable

lists of allowable chemicals and materials for each waste type. Wherever applicable, the chemical lists indicate constituents that were reacted prior to the generation of the waste in its final form. Any process changes in waste generation are evaluated by the Waste Certification Engineer to ensure that compliance with the chemical constituent requirements is met. As required by the TRUPACT-II SARP, potential changes that may require reclassification of a given waste form into a different waste type will be documented in a revision to the TRUCON document, which will be submitted for formal approval by the NRC.

4.3 Method of Verification

Verification activities will be performed by personnel who have completed the course EP 0021, "TRU Waste Certification Program," and have received approval from the Facility Manager. Waste parcel verifiers will examine the waste for prohibited items, such as free liquids, compressed gases, explosives, pyrophorics, and reactives, before packaging and will then sign the LLNL TRU Waste Parcel Card discussed in Section 2.3 (*Appendix H of the Building 332 FSP* and *Procedure TIP-HEF-008*).

5. Chemical Compatibility

5.1 Requirements

Chemical compatibility of a waste with its packaging ensures that chemical processes will not occur that might pose a threat to the safe transport of a payload in the TRUPACT-II. A chemical compatibility study is specifically required to determine the following:

- Chemical compatibility of the waste form within each individual payload container
- Chemical compatibility between contents of payload containers during hypothetical accident conditions
- Chemical compatibility of waste forms within the TRUPACT-II inner containment vessel (ICV)
- Chemical compatibility of the waste form with the TRUPACT-II O-ring seals.

5.2 Method of Compliance

Compliance with the chemical compatibility requirements does not require specific actions by LLNL and is covered by controlling other parameters. Chemical compatibility of the payload materials and the TRUPACT-II package was evaluated in detail in the TRUPACT-II SARP (NuPac 1992). The Chemical Lists document, which is a compilation of the chemical lists from each TRUCON code (including the LLNL waste forms), was used to determine if all of the chemicals and materials that could be present within a TRUPACT-II payload were compatible.
An Environmental Protection Agency method of assessing the compatibility of chemicals and materials was used in this determination (Hatayama et al. 1980). As documented in Attachment B-2 to the TRUPACT-II SARP, this evaluation showed that the allowable payload materials in the TRUPACT-II are chemically compatible, based on the physical form and chemical constituents present in the waste. Evaluations of the chemical compatibility of the payload materials and the TRUPACT-II components (the ICV and the O-rings) are documented in Appendices 2.10.11 and 2.10.12 of the TRUPACT-II SARP. These evaluations show that the allowable payload for the TRUPACT-II is compatible with the package.

Based on the above evaluations, the authorized LLNL waste forms listed in Table 2-3 meet the chemical compatibility requirements of the TRUPACT-II package.

6. Gas Distribution and Pressure Buildup

6.1 Requirements

Gas generation and pressure buildup during transport of CH-TRU wastes in the TRUPACT-II payload are restricted to the following limits:

- The gases generated in the payload must be controlled to prevent the occurrence of potentially flammable concentrations of gases within the payload confinement layers and the void volume of the ICV cavity. Specifically, hydrogen concentrations within the payload confinement layers are limited to 5% by volume during a maximum 60-day shipping period.

- The gases generated in the payload and released into the ICV cavity must be controlled to maintain the pressure within the TRUPACT-II ICV cavity below the acceptable design package limit of 50 psig.

6.2 Method of Compliance

As documented in the TRUPACT-II SARP, compliance with the gas distribution and pressure buildup requirements does not require specific actions by LLNL and is achieved by controlling other parameters, as follows:

- Restricting the chemicals and materials that are present within each waste type

- Limiting the maximum number of internal layers of confinement within each payload container and using filters in the payload containers

- Limiting the allowable decay heat within each payload container.

In this document, chemical properties are discussed in Chapter 4, the payload container type and configuration of the contents are discussed in Chapter 7, and decay heat is discussed in Chapter 9.

7. Payload Container and Contents Configuration

7.1 Requirements

7.1.1 Payload Container and Overpacking Configuration

The payload container for each TRUPACT-II shipment must be a 55-gallon drum, an SWB, or a ten-drum overpack (TDOP). Each payload container must meet the applicable requirements of Appendices 1.3.3 and 1.3.4 of the TRUPACT-II SARP. In addition to meeting these specifications at the time of procurement, the integrity of each payload container must be inspected prior to transport. Drums that appear by visual inspection to be corroding must be overpacked, as needed.

In addition to the above specifications, payload containers and overpacking configurations must conform to the shipping category designations, shown in Table 2-2, and applicable content code descriptions in the TRUCON document.

7.1.2 Payload Container Filters

Each payload container to be transported in the TRUPACT-II must have one or more filter vents. Appendix 1.3.5 of the TRUPACT-II SARP specifies the flow and hydrogen diffusion requirements for these filters. The minimum number of filter vents shall be one for a drum, two for an SWB, two for a bin overpacked in an SWB, and nine for a TDOP. All filters installed in drums must meet the specifications in Section 2.0 of Appendix 1.3.5 of the TRUPACT-II SARP. All filters installed in SWBs must meet the specifications of Section 3.0 of Appendix 1.3.5 of the TRUPACT-II SARP. All filters installed in TDOPs must meet the specifications of Section 5.0 of Appendix 1.3.5 of the TRUPACT-II SARP.

7.1.3 Rigid Liners

A rigid liner, if present in a payload container, must be punctured (with a $\geq$0.3-inch-diameter hole) or filtered before the container can be transported in a TRUPACT-II. Specifications are provided in Appendix 1.3.3 of the TRUPACT-II SARP.

7.1.4 Inner Confinement Layers

The inner layers of confinement around the waste material in the payload containers must be plastic bags and/or metal cans that meet the specifications outlined in Appendix 1.3.6 of the TRUPACT-II SARP. The plastic bags must be closed with either a twist-and-tape or fold-and-tape method. For waste within a given TRUCON code, the maximum number of layers of bags is specified in the TRUCON document.

Table 7-1 lists the maximum number of payload container inner bags, liner bags, and total bags allowed for each LLNL TRUCON code.

Table 7-1 Approved LLNL Payload Configurations for TRUPACT-II Shipments[a]

TRUCON Code/LLNL Waste Form No.	Shipping Category	Maximum Number of Inner Bags	Maximum Number of Liner Bags	Total Number of Bags
LL 111A/002	I.1A0	0	0	0
	I.1B0	0	0	0
LL 113A/002	IV.1A3T	2	1	3
	IV.1B3T	2	1	3
LL 116A/001	III.1A3	2	1	3
	III.1B3	2	1	3
LL 124A/004	II.2AM	N/A	N/A	N/A
	II.2BM	N/A	N/A	N/A
LL 124B/004	II.1A3	2	1	3
	II.1B3	2	1	3
LL 125A/003	III.1A3	2	1	3
	III.1C2	0	2	2

[a]The information contained in this table was obtained from the TRUCON document (DOE 1992).

7.1.5 Venting and Aspiration

If LLNL adds filters to unvented payload containers of waste, the payload containers must be aspirated for a sufficient period of time to ensure that there is equilibration of gases that may have accumulated in the closed containers prior to transport. The procedures to be followed for aspiration and determination of aspiration time are presented in Appendix 3.6.11 of the TRUPACT-II SARP. Three options are provided for showing compliance with aspiration requirements, any one of which may be implemented:

- Option 1—Aspiration Time Based on Date of Drum Closure: This option determines aspiration time based on the closure date of the payload container and the TRUCON code. This method does not require headspace gases to be sampled.

- Option 2—Headspace Gas Sampling at the Time of Venting: This option determines aspiration time based on the measured concentration of hydrogen in the headspace of the drum (between the drum lid and the rigid liner) at the time of venting.

- Option 3—Headspace Gas Sampling During Aspiration: This option utilizes the measured headspace concentration of hydrogen two or more weeks after venting to determine aspiration time.

7.2 Method of Compliance

Waste containers for use at LLNL are currently procured only from other DOE facilities that have an approved certification plan. The HWM Division and the Hazardous Material Packaging and Transportation Safety (HMPTS) Committee are responsible for procuring all waste containers and ensuring that the containers are procured from vendors with approved certification plans. As discussed in Section 2.2, the LLNL TRU Waste Container Inspection Card and the LLNL TRU Waste Container Final Inspection Card are used to ensure compliance with the payload configuration and packaging requirements. Specific generator procedures that address compliance with waste container requirements include *Procedure TIP-HEF-009* and *Appendix H of the Building 332 FSP*.

The following subsections outline the procedures that ensure compliance with each of the payload container and packaging configuration requirements.

7.2.1 Payload Container and Overpacking Configuration

In compliance with payload container requirements, three types of containers are procured by the HMPTS Committee and HWM Division for use at LLNL (*HWM Procedure No. 201, "Standard Operating Procedure"*):

- Fifty-five gallon DOT Specification Type 17C or UN 1A2 galvanized or painted steel drums

- DOT Specification 7A steel TRUPACT-II SWBs, which are noncombustible and meet all applicable requirements of Title 49, Code of Federal Regulations (CFR) Part 173 (49 CFR 173) for Type A packaging

- DOT Specification 7A steel TRUPACT-II TDOPs, which will be certified to be noncombustible and to meet all applicable requirements of 49 CFR 173 for Type A packaging.

Container procurement records are maintained by the Waste Certification Program and by the HMPTS Committee. These records will be retained permanently, in accordance with *Procedure WCP-4, "Records Control."*

Empty waste containers are visually inspected by HMPTS-qualified personnel upon receipt from the vendor and are independently inspected by an HWM Technician (*HWM Procedure No. 202*) and the waste generator (or a designee) upon receipt of the empty container from the HWM Division (*Appendix H of the Building 332 FSP* and *Procedure TIP-HEF-009*). The designee must have the same training as a waste generator in container inspection. The results of the container inspection are documented for each container individually. The containers, both drums and boxes, are inspected for the presence of holes, significant rust, bad seams or welds, and any other defects that may compromise container integrity. Damaged containers are segregated and returned to the HWM Division. The specifications of the drums (i.e., size and type [17C or 1A2]) are also marked on the LLNL TRU Waste Container Inspection Card. The containers are also visually inspected after the waste is packaged. This inspection is conducted by the HWM Division upon receipt of the filled waste container from the generators. The results of this inspection are documented by the HWM Division on the LLNL TRU Waste Container Final Inspection Card. Both the LLNL TRU Waste Container Inspection Card and the LLNL TRU Waste Container Final Inspection Card are reviewed and approved by the Waste Certification Engineer.

7.2.2 Payload Container Filters

Procurement controls at LLNL ensure compliance with the specifications for filter vents. As described earlier, waste containers are currently procured only from other DOE facilities with approved certification plans with the filters installed in the containers. As part of the documentation for the LLNL TRU Waste Container Inspection Card and the LLNL TRU Waste Container Final Inspection Card, the presence of the filter vents in all waste containers is verified and checked. Visual inspection is also used to ensure compliance with the number and type of filters on each payload container (*HWM Procedure No. 202*).

7.2.3 Rigid Liners

The payload container inspection by HWM and the generators includes documentation of compliance with the rigid liner requirements, including verification of a vent hole at least 0.3 inches in diameter. The results of the inspections are documented on the LLNL TRU Waste Container Inspection Card (*HWM Procedure No. 202*).

7.2.4 Inner Confinement Layers

Waste packaging procedures followed by the generators at LLNL ensure compliance with the requirements of inner confinement layers. Waste packaging procedures are specific to each of the LLNL waste forms and are as documented in the TRUCON document. These procedures are also the basis for the shipping categories assigned to these waste forms. For each waste form, the procedures specify the bagging procedure and the method of closure for the plastic bags. Only twist-and-tape or fold-and-tape closures are allowed and are used by the generators. No other closure methods have been used for TRU waste at LLNL.

7.2.5 Venting and Aspiration

Venting and aspiration apply only to those waste containers that were sealed at the time of generation. Very few of these containers exist at LLNL. Compliance with the aspiration requirements is ensured using one of the options described in Section 7.1.5, by allowing the waste containers to aspirate for the required amount of time before shipment. Compliance will be documented as described in Chapter 12 for each individual payload container before a waste container is qualified for transport.

7.3 Method of Verification

As specified in Section 2.3, authorized waste parcel verifiers will be in attendance during the packaging of both waste parcels and waste containers. These verifiers will also check to make sure that the LLNL TRU Waste Parcel Card and the LLNL TRU Waste Disposal Requisition are filled out completely and correctly before signing the appropriate portions themselves. In addition, in the certification process, the Waste Certification Engineer (see Section 2.3) reviews all forms, including the LLNL TRU Waste Container Inspection Card. These activities ensure that the payload container requirements discussed in the previous sections are met. As discussed in Chapter 12, the Transportation Certification Official documents compliance for each waste container before it is qualified for transport in the TRUPACT-II. Additional responsibilities of the Transportation Certification Official and the Waste Certification Official are discussed in Chapter 13, Sections 13.1.2.3 and 13.1.2.4, respectively.

8. Isotopic Inventory and Fissile Content

8.1 Requirements

The isotopic inventory for each payload container provides both the isotopic composition of the radioactive material and the total quantity plus error of all radioactive material, including both fissile and nonfissile TRU radionuclides and non-TRU radionuclides. The Pu-239 fissile gram equivalent (FGE) and the identity and quantity of individual radionuclides or mixtures are recorded for individual payload containers and are summarized in the data sheet of the total TRUPACT-II payload.

Two limits for TRUPACT-II payload compliance require a knowledge of the specific isotopic composition and radionuclide quantity:

- Pu-239 FGE (discussed in Chapter 8)
- Decay heat (discussed in Chapter 9).

8.1.1 Isotopic Composition

The isotopic composition of the waste is determined from measurements taken on the product material upon receipt from sources outside LLNL. The isotopic composition of waste in Building 251 is determined by measurements made on the waste parcel using gamma spectrometry when the waste is generated. The waste generator records the composition (e.g., the grade of plutonium) on the LLNL TRU Waste Parcel Card. If the grade is not a standard mix, the radionuclide information is recorded separately on the LLNL TRU Waste Parcel Card.

8.1.2 Fissile Content

A payload container is acceptable for transport in a TRUPACT-II only if the Pu-239 FGE plus two times the error is below:

- 200 grams per drum
- 325 grams per SWB.

Prior to loading the TRUPACT-II, the Pu-239 FGE for each payload container is summed to compute the total measured Pu-239 FGE for the proposed TRUPACT-II payload. The total Pu-239 FGE error is the square root of the sum of the squares of the individual Pu-239 FGE errors. The total shipment Pu-239 FGE (measured value plus total error) must be less than 325 grams to meet the payload compliance limit. If not, a different combination of payload containers is selected. This process of load

management continues until a group of payload containers is identified that meets the TRUPACT-II Pu-239 FGE limit.

8.2 Method of Compliance

8.2.1 Radionuclide Quantity

LLNL uses five types of plutonium: weapons grade, fuel grade, reactor grade, Am-enriched grade, and mixed grade. In Building 251, research samples of plutonium isotopes are generated as well. Incoming shipments are verified for isotopic distribution using calorimetry and gamma spectrometry. The normal isotopic distribution for each type of plutonium is shown in Table 8-1. Building 251 generates nonstandard mixes that are assayed.

Assay of solid waste from the Plutonium Facility at LLNL is performed by the MM Section using a Segmented Gamma Scanner (SGS). The step-by-step instructions for performing assay using the SGS are provided to the assay personnel in *Procedure MM-V-06, "Segmented Gamma Scanner Operation."* Personnel operating the SGS are required to be currently qualified SGS users and must have successfully completed MM Training Course MM0705. Personnel performing waste drum assay are required to have TID training. In addition, each operator is required to be authorized as a TID user and certified as a Radiation Zone Worker I.

The SGS is calibrated pursuant to *Procedure MM-V-14, "Segmented Gamma Scanner Calibration,"* each time the transmission source is changed or whenever it is determined to be required by the MM Statistician or measurement verification staff engineer. All of the drums have the TID affixed before they are assayed. The information regarding the TID seals on the containers is recorded on the LLNL TRU Waste Disposal Requisition.

Prior to assaying of waste drums each week, an empty drum standard and the 20-gram standard drum are measured on the SGS (a 100-gram standard drum will be incorporated into the calibration procedures when available). The results are input into the Operations Log Book and reviewed and compared to acceptable measured values and acceptable limits. Standard measurements are also needed each time the SGS is restarted. Each drum is measured individually pursuant to procedure. At the completion of the assay, the computer prints out the quantity of Pu-239 in the waste drum, which is recorded on the LLNL TRU Waste Disposal Requisition.

Table 8-1. Normal Isotopic Distribution for LLNL Plutonium Grades[a]

Plutonium Type	Radionuclide	Ratio of Radionuclide (Weight Percent)
Weapons grade	Pu-238	0.016%
	Pu-239	93.464%
	Pu-240	5.900%
	Pu-241	0.381%
	Pu-242	0.040%
	Am-241	0.202%
Fuel grade	Pu-238	0.066%
	Pu-239	78.964%
	Pu-240	17.427%
	Pu-241	1.180%
	Pu-242	0.432%
	Am-241	1.942%
Reactor grade	Pu-238	0.011%
	Pu-239	73.657%
	Pu-240	24.896%
	Pu-241	0.424%
	Pu-242	0.018%
	Am-241	0.994%
Am-enriched grade	Pu-238	0.055%
	Pu-239	63.557%
	Pu-240	14.027%
	Pu-241	0.950%
	Pu-242	0.347%
	Am-241	21.073%
Mixed grade	Pu-238	0.042%
	Pu-239	86.149%
	Pu-240	11.714%
	Pu-241	0.784%
	Pu-242	0.237%
	Am-241	1.079%

[a]The information presented in this table was obtained from the HWM Division database.

For waste generated from the Heavy Element Facility, assay of the waste parcels is performed using gamma counting techniques outlined in *Procedure TIP-HEF-010, "Gamma Ray Spectrometry of Waste Parcels Procedures."* The assay results on the quantity of radionuclides in each parcel are entered on the LLNL TRU Waste Parcel Card. For each waste container (with more than one parcel), the assay values from each waste parcel are then summed and entered on the LLNL TRU Waste Disposal Requisition.

8.2.2 Plutonium-239 FGE

The assay results are used by the MM Section of the Applied Research Engineering Division to calculate the Pu-239 content from count-rate data and are recorded on the LLNL TRU Waste Disposal Requisition. This content value is also entered into the HWM computer database program, which is programmed to calculate the total activity (Ci) content based on known radionuclide composition and the specific activity (Ci/g). The Pu-239 FGE can then be calculated from this information. Pu-239, U-233, and U-235 are considered to be equivalent fissile materials. The Pu-239 FGE for other fissile or fissionable isotopes, including special actinide elements, are listed in Table 8-2, based on American National Standards Institute (ANSI)/American Nuclear Society Standard 8.15-1981, "Nuclear Criticality of Special Actinide Elements" (ANSI 1981). The error information is obtained from the accuracy of the assay methods used and is recorded for each payload container prior to qualifying a container for shipment. Chapter 12 discusses the data forms containing this information. Compliance with the FGE limits is assured by comparing the measured value (plus two times the error) against the applicable limit.

Table 8-2. Pu-239 FGE, Decay Heat, and Specific Activity of Selected Radionuclides[a]

Nuclide	Atomic Number	Pu-239 FGE	Decay Heat (W/g)	Specific Activity (Ci/g)
H 3	1	0.00E+00	3.28E–01	9.76E+03
C 14	6	0.00E+00	1.32E–03	4.51E+03
Na 22	11	0.00E+00	8.94E+01	6.32E+03
P 32	15	0.00E+00	1.19E+03	2.89E+05
Mn 54	25	0.00E+00	3.88E+01	7.82E+03
Fe 55	26	0.00E+00	8.49E-02	2.44E+03
Co 57	27	0.00E+00	7.29E+00	8.55E+03
Co 60	27	0.00E+00	1.76E+01	1.14E+03
Ni 63	28	0.00E+00	6.05E–03	5.98E+01
Cu 64	29	0.00E+00	7.21E+03	3.89E+06
As 73	33	0.00E+00	1.02E+01	2.25E+04
Kr 85	36	0.00E+00	5.94E-01	3.97E+02
Rb 86	37	0.00E+00	3.71E+02	8.22E+04
Sr 89	38	0.00E+00	1.01E+02	2.94E+04
Sr 90	38	0.00E+00	1.60E-01	1.38E+02
Y 88	39	0.00E+00	2.24E+02	1.41E+04
Zr 88	40	0.00E+00	4.45E+01	1.80E+04
Zr 95	40	0.00E+00	1.10E+02	2.17E+04
Ru 103	44	0.00E+00	1.05E+02	3.26E+04
Ru 106	44	0.00E+00	2.00E–01	3.38E+03
Ag 110	47	0.00E+00	7.99E+01	4.80E+03
Cd 109	48	0.00E+00	1.68E+00	2.61E+03
Sb 125	51	0.00E+00	3.27E+00	1.04E+03
I 125	53	0.00E+00	6.38E+00	1.76E+04
I 129	53	0.00E+00	9.34E–08	1.79E–04
I 131	53	0.00E+00	4.23E+02	1.25E+05
Cs 134	55	0.00E+00	1.33E+01	1.31E+03
Cs 137	55	0.00E+00	9.74E–02	8.80E+01
Ba 133	56	0.00E+00	6.82E–01	2.53E+02
Ce 141	58	0.00E+00	4.19E+01	2.88E+04
Ce 144	58	0.00E+00	2.14E+00	3.22E+03
Pm 147	61	0.00E+00	3.44E–01	9.38E+02
Sm 151	62	0.00E+00	3.10E–03	2.66E+01

Refer to footnote at end of table.

Table 8-2. Pu-239 FGE, Decay Heat, and Specific Activity of Selected Radionuclides[a] (Continued)

Nuclide	Atomic Number	Pu-239 FGE	Decay Heat (W/g)	Specific Activity (Ci/g)
Eu 152	63	0.00E+00	1.35E+00	1.78E+02
Eu 154	63	0.00E+00	2.39E+00	2.67E+02
Eu 155	63	0.00E+00	3.42E–01	4.70E+02
Tm 168	69	0.00E+00	8.39E+01	8.44E+03
Ta 182	73	0.00E+00	5.60E+01	6.31E+03
Pb 210	82	0.00E+00	1.96E–02	7.72E+01
Po 210	84	0.00E+00	1.45E+02	4.54E+03
Ra 223	88	0.00E+00	1.83E+03	5.18E+04
Ra 226	88	0.00E+00	2.88E–02	1.00E+00
Ra 228	88	0.00E+00	2.76E–02	2.76E+02
Ac 227	89	0.00E+00	3.68E–02	7.32E+01
Th 228	90	0.00E+00	2.71E+01	8.29E+02
Th 230	90	0.00E+00	5.75E–04	2.04E–02
Th 232	90	0.00E+00	2.68E–09	1.11E–07
Pa 231	91	0.00E+00	1.46E–03	4.78E–02
U 232	92	0.00E+00	6.93E–01	2.16E+01
U 233	92	1.00E+00	2.84E–04	9.76E–03
U 234	92	0.00E+00	1.82E–04	6.32E–03
U 235	92	1.00E+00	6.04E–08	2.19E–06
U 236	92	0.00E+00	1.78E–06	6.54E–05
U 237	92	0.00E+00	1.64E+02	8.25E+04
U 238	92	0.00E+00	8.62E–09	3.40E–07
Np 237	93	1.50E–02	2.09E–05	7.13E–04
Pu 236	94	0.00E+00	1.87E+01	5.37E+02
Pu 238	94	1.13E–01	5.73E–01	1.73E+01
Pu 239	94	1.00E+00	1.95E–03	6.29E–02
Pu 240	94	2.25E–02	7.16E–03	2.30E–01
Pu 241	94	2.25E+00	3.31E–03	1.04E+02
Pu 242	94	7.50E–03	1.17E–04	3.97E–03
Pu 244	94	0.00E+00	5.22E–07	1.79E–05
Am 241	95	1.87E–02	1.16E–01	3.47E+00
Am 242	95	3.45E+01	4.32E–03	9.83E+00
Am 243	95	1.29E–02	6.49E–03	2.02E–01

Refer to footnote at end of table.

Table 8-2. Pu-239 FGE, Decay Heat, and Specific Activity of Selected Radionuclides[a] (Continued)

Nuclide	Atomic Number	Pu-239 FGE	Decay Heat (W/g)	Specific Activity (Ci/g)
Cm 242	96	0.00E+00	1.23E+02	3.35E+03
Cm 243	96	5.00E+00	1.90E+00	5.22E+01
Cm 244	96	9.00E–02	2.86E+00	8.18E+01
Cm 245	96	1.50E+01	5.77E-03	1.74E–01
Cm 246	96	0.00E+00	1.02E–02	3.11E–01
Cm 247	96	5.00E–01	2.98E–06	9.38E–05
Cm 248	96	0.00E+00	5.53E–04	4.30E–03
Cm 250	96	0.00E+00	1.59E–01	2.10E–01
Bk 247	97	0.00E+00	3.69E–02	1.06E+00
Bk 249	97	0.00E+00	3.24E–01	1.66E+03
Cf 249	98	4.50E+01	1.54E–01	4.14E+00
Cf 250	98	0.00E+00	4.12E+00	1.11E+02
Cf 251	98	9.00E+01	5.89E–02	1.60E+00
Cf 252	98	0.00E+00	4.06E+01	5.44E+02
Es 252	99	0.00E+00	4.37E+01	1.11E+03
Es 254	99	0.00E+00	7.35E+01	1.88E+03

[a]The information in this table was obtained from Appendix 1.3.7 of the TRUPACT-II SARP (NuPac 1992).

9. Decay Heat

9.1 Requirements

There are two limits for decay heat: (1) the total decay heat from the radioactive decay of the radioisotopes within an individual payload container and (2) the total decay heat from all payload containers in a TRUPACT-II. Decay heat is determined by calculations using the isotopic inventory information for fissile and nonfissile TRU radionuclides and for any non-TRU radionuclides present in a container.

The decay heat of each radionuclide is calculated using the decay heat conversions shown in Table 8-2. The decay heat of individual payload containers is calculated by combining the isotopic inventory data (which are obtained as described in Section 8.1) and the calculated decay heat for each radionuclide. The calculated value of the decay heat for an individual payload container and the decay heat error are recorded in the data package for an individual payload container. A container in a given shipping category is transported in TRUPACT-II only if the measured decay heat plus error ($1\ \sigma$) is below the limits for that shipping category, which are shown in Table 9-1 for the LLNL waste forms.

The decay heat for each payload container is summed to compute the total calculated decay heat for a TRUPACT-II payload. The total decay heat error is calculated as the square root of the sum of the squares of the individual decay heat error values. The total shipment decay heat value (calculated value plus total error) is compared to the TRUPACT-II limit for decay heat. Only those payloads that meet the decay heat limit may be transported in the TRUPACT-II.

9.2. Method of Compliance

The HWM Division computer at LLNL is programmed to calculate thermal output from the assay data reported on the LLNL TRU Waste Disposal Requisition. Decay heats for radionuclides are entered into the HWM Division computer and are used along with the assay data to determine a total calculated decay heat for the container. The error information is obtained from the accuracy of the assay methods used and is recorded for each payload container prior to qualifying a container for shipment. Chapter 12 discusses the data forms containing this information. Compliance with the decay heat limits is assured by comparing the measured value (plus the error) against the decay heat limit for the applicable shipping category. Waste containers that exceed decay heat limits fall into the test category and cannot be qualified for transport unless tested individually for their gas generation potential. The TRUPACT-II Gas Generation Program, described in Attachment 2.0 of Appendix 1.3.7 of the TRUPACT-II SARP, describes the experimental program to be used for qualifying test category waste for transportation. This program will be

implemented at LLNL for the qualification of test category waste that includes containers that exceed decay heat limits and those belonging to Waste Type IV.

Table 9-1. Decay Heat Limits for LLNL Waste Forms

TRUCON Code/LLNL Waste Form No.	Waste Form Description	Shipping Category	Decay Heat Limit per Container (in watts)[a]	Decay Heat Limit per TRUPACT-II (in watts)[a]
LL 111A/002	Solidified Liquid Waste	I.1A0 I.1B0	0.2060 0.1457	2.8840 1.1656
LL 113A/002	Solidified Liquid Waste	IV.1A3T IV.1B3T	Test Category Test Category	Test Category Test Category
LL 116A/001	Glove Box Waste	III.1A3 III.1B3	0.0280 0.0260	0.3920 0.2080
LL 124A/004	Waste Salt Blocks	II.2AM II.2BM	40 40	40 40
LL 124B/004	Waste Salt Blocks	II.1A3 II.1B3	0.0561 0.0520	0.7854 0.4160
LL 125A/003	Metal Scrap Waste	III.1A3 III.1C2	0.0280 0.2680	0.3920 0.5360

[a]Decay heat limits were obtained from the TRUCON document (DOE 1992).

10. Weight and Center of Gravity

10.1 Requirements

The TRUPACT-II SARP (NuPac 1992) outlines restrictions placed on the weight of individual payload containers, the payload assembly, and loaded TRUPACT-IIs and on the center of gravity of each payload assembly. The weight limits are as follows:

- 1,000 pounds per drum (1,450 pounds per drum overpacked in an SWB)
- 4,000 pounds per SWB
- 7,265 pounds per payload assembly of 14 drums (including pallet, guide tubes, slip sheets, and reinforcing plates)
- 7,265 pounds per payload assembly of two SWBs or one TDOP
- 19,250 pounds per loaded TRUPACT-II.

The center of gravity requirements are as follows:

- The total weight of the top seven drums or SWB must be less than or equal to the total weight of the bottom seven drums or SWB
- The total weight of the top five drums in a TDOP must be less than or equal to the total weight of the bottom five drums.

The weight of each payload container must be measured and recorded in the database for individual containers, along with an estimate of the error in the weight. The weight and error of the total TRUPACT-II payload is calculated and reported in the TRUPACT-II payload data sheets (described in Chapter 12). The Transportation Certification Official reviews the payload data sheets and approves the weight of each individual container and the total payload.

10.2 Method of Compliance

10.2.1 Individual Payload Container Weight

Individual payload containers are weighed by the HWM Division as outlined in *HWM Procedure No. 203, "TRU Waste Shipment Preparation Procedure."* Prior to the weighing of a payload container, the scale is calibrated using a standard known weight. If the scale read-out deviates from the weight of the standard by more than 1% (±1%), the scale is recalibrated by the vendor.

Once the scale is calibrated satisfactorily, the payload container weight is obtained by measurement from the scale. If the measured weight of the payload container (including the error) exceeds 1,000 lbs for drums (currently LLNL uses an 800-lb limit for drums) or 4,000 lbs for SWBs, the waste container is considered to be nonconforming, and a Nonconformance and Corrective Action Report (NCAR) is initiated in accordance with *Procedure WCP-3, "Nonconformance Reporting"* The nonconforming container is segregated for corrective action.

If the waste container meets applicable weight limits, the weight of the container is recorded on the LLNL TRU Waste Radiological Survey Card by the HWM Technician, who also dates and signs the information entered on the card. In addition, for containers that are being certified for shipment, this information is entered on the Payload Container Transportation Certification Document (PCTCD) (described in Chapter 12) and reviewed by the Transportation Certification Official.

10.2.2 TRUPACT-II Payload Weight

The TRUPACT-II payload weight limit of 7,265 lbs includes a payload of 14 drums and the payload pallet, optional slip sheets, reinforcing plates, guide tubes, and banding material OR a payload of two SWBs and optional nylon-strap assemblies. The total payload weight can be obtained either from the weights and associated errors of the individual components or by weighing the complete assembly. The Transportation Certification Official reviews and approves the total payload assembly and records the weight on the Payload Assembly Transportation Certification Document (PATCD) (described in Chapter 12).

10.2.3 Center of Gravity of the Loaded TRUPACT-II

Compliance with the center-of-gravity requirements is ensured by placing the heavier 7-pack of drums or the heavier SWB at the bottom of the TRUPACT-II. This is verified and recorded by the Transportation Certification Official on the PATCD, as described in Chapter 12.

11. Radiation Dose Rate

11.1 Requirements

The external radiation dose rates of individual payload containers and the three loaded TRUPACT-II payloads to be shipped on a trailer must be less than or equal to 200 mrem/hour at the surface and 10 mrem/hour at a distance of 2 meters, as specified in the TRUPACT-II SARP (NuPac 1992). The radiation dose rates for the TRUPACT-II must also comply with 10 CFR 71.47.

Occasionally, drums of CH-TRU waste that meet the surface dose radiation limits require shielding to meet DOE site requirements. The radiation level at the surface of and at a distance of 2 meters from the unshielded payload container is measured to ensure compliance with the 200 mrem/hour and 10 mrem/hour limits, respectively. If the measured radiation levels are below the specified levels but do not meet site criteria, shielding may be added to the drum. Drums that exceed the 200 mrem/hour surface reading or 10 mrem/hour at 2 meters without shielding may not be transported in the TRUPACT-II.

11.2 Method of Compliance

Surface-dose rates of the individual payload containers are measured by an HWM Field Technician or by a Hazards Control Department Health and Safety Technician, pursuant to *HWM Procedure No. 203*. For all survey instruments, it is ensured that the calibration is current and that a response check is performed to determine if the instrument is functioning. The results of these checks are recorded and signed by the facility technician. Once the survey instruments have been determined to be satisfactory, the beta-gamma and neutron dose rates for each container are measured at the surface and recorded on the LLNL TRU Waste Radiological Survey Card. If the combined dose rate exceeds 200 mrem/hour for any container, the container is identified as nonconforming, and an NCAR is initiated in accordance with *Procedure WCP-3*. The nonconforming container is rejected from being a TRUPACT-II authorized package and is segregated for corrective action (*Procedure WCP-2*).

The TRUPACT-II surface is surveyed before shipping, and the highest combined gamma and neutron reading is recorded. If this reading exceeds 200 mrem/hour combined gamma and neutron, it is rejected from shipment, and an NCAR is initiated. Additionally, the reading from a TRUPACT-II must not exceed 10 mrem/hour at a distance of 2 meters from any side of the TRUPACT-II (excluding the top and bottom). After the TRUPACT-IIs are loaded onto the truck, the vehicle's driver and passenger space are surveyed to ensure that the dose rate does not exceed 2 mrem/hour.

12. Payload Assembly Criteria

12.1 Requirements

This section describes the control procedures that must be used to assemble a payload approved for transport in the TRUPACT-II. The parameters described in previous chapters must be evaluated according to the constraints in Section 1.2.3 of the TRUPACT-II SARP (NuPac 1992) for selection of a payload.

Only content codes described in the TRUCON document may be transported in the TRUPACT-II. The TRUCON document provides the assignment of each content code to a payload shipping category. The logic for this classification of LLNL waste is presented in Chapter 2 of this document.

Shipping categories impose restrictions and requirements on the manner in which a payload can be assembled. These restrictions and requirements are as follows:

- After all the payload parameters have been quantified and verified, the shipping category must be clearly marked on the payload container to provide a visual verification that the container is authorized for shipment.

- All containers forming a payload within each TRUPACT-II must belong to the same shipping category. This precludes the mixing of different Waste Material Types (i.e., I.1, I.2, I.3, II.1, II.2, III.1 and IV.1), different payload containers (i.e., drums and SWBs), and different internal packaging configurations (i.e., number of bag layers). This requirement also applies for up to four drums overpacked in an SWB or for up to ten drums overpacked in a TDOP, each of which must belong to the same shipping category. The shipping category is marked on the SWB and the TDOP, if used. The Transportation Certification Official and the Waste Certification Official verify that there is no mixing of shipping categories within a payload.

- Payload containers qualified for transport in the analytical and test categories cannot be mixed in a TRUPACT-II package.

- Transportation parameters of individual payload containers are recorded on a Payload Container Transportation Certification Document (PCTCD). There is a PCTCD for the analytical payload shipping category and one for the test payload shipping category. Examples of these forms are provided in Figures 12-1 and 12-2, respectively. The information on these forms should be available for each payload container, even if the format is not identical to that shown in Figures 12-1 and 12-2 (e.g., use of a computer-generated form is acceptable provided all information is included). A payload container may be

Container I.D. #: _____
Content Code: _____
Container Type:
Drum _____
SWB _____
TDOP _____
Certification Site: _____

Payload Shipping Category: _____
Decay Heat Limit for Category: _____
Transportation WAC Certified: _____
Liner Punctured / Filtered: _____
Correct Filter(s) Installed: _____
Filter(s) Model: _____

- Aspiration Method: Option 1 _____ Option 2 _____ Option 3 _____
- Period of Time Container Closed Prior to Venting _____ (Option 1 only)
- Hydrogen Concentration in Headspace _____ (Option 2 or Option 3)
- Period of Aspiration: _____ Table: _____
- Payload Container has Vented the Indicated Period of Time: _____

Container Weight _____ + Error _____ = _____
Container Decay Heat _____ + Error _____ = _____
Container Fissile Mass _____ + 2 times the Error _____ = _____
Approved for Shipment _____

I certify that the above container meets the requirements for shipment in TRUPACT-II.

_____
Waste Certification Official

_____
Transportation Certification Official

_____
Date

Figure 12-1. Payload Container Transportation Certification Document (PCTCD) (Analytical Payload Shipping Category)

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Container I.D. #: _____
Content Code: _____
Container Type:
Drum _____
SWB _____
TDOP _____
Certification Site: _____

Payload Shipping Category: _____
Decay Heat Limit for Category: _____
Transportation WAC Certified: _____
Liner Punctured / Filtered: _____
Correct Filter(s) Installed: _____
Filter(s) Model: _____

TEST CRITERIA:

Limit for Total Gas Generation: _____

Measured Gas Generation Rate: _____

Limit for Hydrogen Gas Generation: _____

Measured Hydrogen Generation Rate: _____

Limit for Flammable Volatile Organics Concentration: _____

Concentration of Flammable VOCs Present: _____

Container Weight _____ + Error _____ = _____

Container Decay Heat _____ + Error _____ = _____

Container Fissile Mass _____ + 2 times the Error _____ = _____

Approved for Shipment _____

I certify that the above container meets the requirements for shipment in TRUPACT-II

_____
Waste Certification Official

_____
Transportation Certification Official

_____
Date

Figure 12-2. Payload Container Transportation Certification Document (PCTCD) (Test Payload Shipping Category)

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certified for transport only if all the transportation parameters are in compliance. The Transportation Certification Official and the Waste Certification Official are responsible for verifying this compliance before authorizing containers for transport. Step-by-step instructions for completing Figures 12-1 and 12-2 are provided in Sections 12.2.1 and 12.2.2.

- The transportation parameters of every TRUPACT-II shipment are recorded on the Payload Assembly Transportation Certification Document (PATCD), which is shown in Figure 12-3. The information on this form should be available for each payload assembly, even if the format is not identical to that shown in Figure 12-3 (e.g., use of a computer-generated form is acceptable provided all information is included). A TRUPACT-II shipment is authorized only if all the transportation parameters are in compliance. The Transportation Certification Official and the Waste Certification Official are responsible for verifying this compliance before authorizing a shipment for transport. Step-by-step instructions for completing the data sheet shown in Figure 12-3 are provided in Section 12.2.3.

12.2 Procedure for Certifying Authorized Payloads for TRUPACT-II

All authorized payloads must meet the requirements set forth in the TRUPACT-II SARP (NuPac 1992). Data on the parameters for specific payloads are obtained by the methods outlined in this document in accordance with the specific limits of the TRUCON document. The following is an overview for evaluating the data against the TRUPACT-II limits and restrictions.

12.2.1 Procedure for Certifying Individual Payload Containers for Transport in the TRUPACT-II (Analytical Case)

As required by the TRUPACT-II SARP, LLNL must qualify an individual payload container for transport in TRUPACT-II by verifying that each container meets the requirements and limits for the parameters listed in Figure 12-1, the PCTCD for the Analytical Case. Analytical cases are wastes that meet the decay heat limits listed in Table 9-1 for the respective shipping categories.

Listed below is the procedure to be followed for the qualification of a payload container for transport (i.e., using Figure 12-1 [or equivalent]). Sections of this document are referenced under each heading, as appropriate, for specific details on each parameter.

TRUPACT-II OCA BODY NO.: _____ SHIPMENT NO.: _____

TRUPACT-II OCA LID NO.: _____

PAYLOAD SHIPPING CATAGORY: _____

DECAY HEAT LIMIT FOR SHIPPING CATEGORY: _____

PAYLOAD CONTAINER CONFIGURATION: _____
(DRUM, SWB, OR OVERPACK [SWB, TDOP])

PAYLOAD COMPOSITION

BOTTOM 7 DRUMS, SWB, OR TDOP

PAYLOAD CONTAINER I.D. NO.*	WEIGHT	ERROR	FISSILE GRAMS	ERROR**	DECAY HEAT	ERROR
		***				
Subtotal						

*For seven-drum configuration, use the first seven rows; for ten-drum overpack configuration, also use the last three rows.

**Two times the error from individual payload containers.

***Error on total weight can be determined by weighing the entire payload assembly.

Figure 12-3. Payload Assembly Transportation Certification Document (PATCD)

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TOP 7 DRUMS OR SWB

PAYLOAD CONTAINER I.D. NO.*	WEIGHT	ERROR	FISSILE GRAMS	ERROR**	DECAY HEAT	ERROR
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____***	_____	_____	_____	_____
Subtotal	_____	_____				

TOTAL FISSILE QUANTITY (WITH ERROR) OF ALL CONTAINERS: _____

TOTAL DECAY HEAT (WITH ERROR) OF ALL CONTAINERS: _____

BOTTOM SEVEN DRUMS OR SWB WEIGHT (WITH ERROR)
≥ TOP SEVEN DRUMS OR SWB WEIGHT (WITH ERROR): _____

TOTAL WEIGHT (WITH ERROR) OF PAYLOAD AND PACKAGE: _____

MAXIMUM DOSE RATE ON THE OUTSIDE OF PACKAGE: _____
AT 2 METERS: _____

DATE OF ICV CLOSURE: _____

APPROVED FOR SHIPMENT: _____

I certify that all of the above containers meet the requirements for shipment in TRUPACT-II.

_____
Waste Certification Official

_____
Transportation Certification Official

_____
Date

*For seven-drum configuration, use the first seven rows; for ten-drum overpack configuration, also use the last three rows.

**Two times the error from individual payload containers.

***Error on total weight can be determined by weighing the entire payload assembly.

Figure 12-3. Payload Assembly Transportation Certification Document (PATCD) (continued)

Container I.D.: The identification number is unique to each container of waste and provides a means for tracking process data records and package history. The container identification number is assigned to the container prior to placement of waste in a container. The I.D. number appearing on a label affixed to the drum can be used for visual verification or for electronic retrieval (i.e., bar codes). The use of bar codes will only be acceptable if accompanied by a legibly written container I.D. Information necessary for transporting payload containers is entered into the data package under this I.D. number. The LLNL TRU Waste Disposal Requisition used with each container at LLNL also serves as a record of the container I.D. number.

Payload Shipping Category: The Transportation Certification Official shall ensure that the proper shipping category is assigned to the payload container and is clearly labeled on the container. The TRUCON document provides shipping category assignments for all TRUCON codes eligible for shipment in TRUCON. This information has been compiled for LLNL waste form numbers in Table 2-3 of this document. The Transportation Certification Official must verify this assignment using the corresponding tables in TRUCON. If the content code is not listed in the TRUCON document, the waste is not eligible for shipment.

Decay Heat Limit for Category: When the shipping category is determined, the allowable decay heat for that category shall be recorded from Table 9-1.

Content Code: This information may be obtained in one of two ways: (1) by acquiring the content code from the data package, where the content code has been preassigned, or (2) if the content code is not available in the data package but the LLNL waste form number is listed on the container, by using Table 2-3 to determine the content code (to be performed by the Transportation Certification Official).

If an LLNL waste form number is not listed in Table 2-3, the payload container is not eligible for shipment. The Transportation Certification Official shall verify that the proper LLNL waste form number and shipping category are assigned to the content code using Table 2-3 or the correlation tables in the TRUCON document.

Container Type: This information may be obtained by visual inspection of the container. The container must be one of the approved types listed in Section 7.1. The LLNL TRU Waste Disposal Requisition also contains this information.

Transportation WAC Certified: This information is obtained from the data package corresponding to the payload container I.D. WIPP WAC certification specifies that the following transportation-related criteria (and others not related to transportation) have been met:

- Free liquids are limited to residual amounts. (Section 3.1)

- Nonradioactive pyrophorics are prohibited. (Section 4.1)
- Explosives are prohibited. (Section 4.1)
- Corrosives are prohibited. (Section 4.1)
- Pressurized containers are prohibited. (Section 3.1)

Check this box if the transportation-related WAC are met.

This information is also recorded on the LLNL TRU Waste Parcel Cards associated with each waste container.

Liner Punctured/Filtered: This information is obtained from the data package for the container I.D. (Section 7.2). Inspection of the punctured liner is recorded on the LLNL TRU Waste Container Inspection Card.

Correct Filter(s) Installed and Filter(s) Model: This information is obtained by visual inspection (Section 7.2). The Transportation Certification Official ensures that the specifications for filters listed in Appendix 1.3.5 of the TRUPACT-II SARP are met. The filter model number is checked with the specification in Appendix 1.3.5. of the TRUPACT-II SARP and recorded on the data sheet. All filters installed in an SWB must meet the specifications in Section 3.0 of Appendix 1.3.5 of the SARP. LLNL obtains the waste containers with the filters installed from other DOE sites with approved certification programs. The filter information is also recorded on the LLNL TRU Waste Container Inspection Cards.

Certification Site: This is the location at which transportation certification takes place, namely LLNL.

Aspiration Time Determination: This part of the form ensures conformance with the requirements on aspiration time for containers that have been closed (unvented) for a period of time (Section 7.2). The five items to be noted under this section are:

- The method for determining the aspiration period necessary to qualify the payload container for transport.

- The period of time that a payload container has been unvented in storage (Option 1 only).

- The concentration of hydrogen measured in the headspace (Options 2 and 3).

- The aspiration time for the option chosen, as well as the table in the TRUPACT-II SARP or TRUCON document from which the value was

derived. If the hydrogen concentration indicates that aspiration is not needed, a zero should be entered.

- Whether or not the payload container was vented for the prescribed amount of time. The answer is "yes" if the task has been accomplished.

Container Weight + Error: The loaded weight of each payload container is obtained from its data package (Section 10.2). This information is also recorded on the LLNL TRU Waste Radiological Survey Card for each container. An error shall be assigned to the container weight and entered into the data package. This resulting value shall be compared to those limits listed in Section 10.1 to ensure compliance.

Decay Heat + Error: The decay heat of each payload container is calculated from the isotopic inventory data, as discussed in Section 9.1. This information is obtained and verified by the Transportation Certification Official from the data package. This information is also recorded on the LLNL TRU Waste Disposal Requisition. The decay heat + error is obtained by the Transportation Certification Official from the data package. The Transportation Certification Official compares this total with the limits for the payload container's shipping category in Table 9-1.

Fissile Mass + Two Times the Error: The Pu-239 FGE is calculated by combining the isotopic inventory data and the Pu-239 FGE for each radionuclide present in the waste, as described in Section 8.2. This information is obtained by the Transportation Certification Official from the container's data package. An error is assigned to the fissile mass as discussed in Section 8.2. This information shall be obtained from the data package by the Transportation Certification Official. The Transportation Certification Official ensures that the fissile mass + two times the error is less than the transport limits listed in Chapter 8.

Approved for Shipment: The Transportation Certification Official ensures that all of the requirements for the above transportation parameters are met. If all transportation parameters are met, the Transportation Certification Official so indicates on this line of the PCTCD. If the requirements are not met, the payload container is rejected (nonconformance disposition) and is not qualified for shipment.

Signatures: The Waste Certification Official and the Transportation Certification Official sign and date the PCTCD upon completion.

12.2.2 Procedure for Certifying Individual Payload Containers for Transport in TRUPACT-II (Test Category)

Payload containers that have been assigned to the test category must meet additional criteria for certification, as shown in Figure 12-2. These criteria evaluations can be made once the TRUPACT-II Gas Generation Test Program for test category waste is instituted at LLNL. The test plan for this program is presented in Attachment 2.0 of Appendix 1.3.7 of the TRUPACT-II SARP. The procedure for completing Figure 12-2 is the same as that for completing Figure 12-1, with the addition of the following items:

Test Criteria: The following data are obtained from the test procedure of each payload container:

> Limit for Total Gas Generation: This limit is defined for each shipping category in Table 3.4.4.3-5 of the TRUPACT-II SARP and is arrived at by setting a maximum pressure limit of 50 psig in the TRUPACT-II ICV cavity.
>
> Limit for Hydrogen Gas Generation: This limit is defined for each shipping category in Table 3.4.4.4-2 of the TRUPACT-II SARP and is arrived at by limiting the maximum hydrogen concentration to less than 5% in all parts of the payload and the package.
>
> Limit for Flammable Volatile Organics Concentration: This limit is set at less than 500 ppm in the headspace (total flammable organics) for all payload containers.

12.2.3 Procedure for Assembly of a TRUPACT-II Payload

Certified payload containers shall be assembled per the instructions given below. Only 14 drums or two SWBs of a single shipping category can be assembled into a specific payload. The total TRUPACT-II package limits are met by ensuring that the restrictions and requirements set forth in this document are met and by evaluating the data from the individual PCTCDs.

The procedures for assembling a payload within a TRUPACT-II are described below. The information required shall be recorded on the PATCD shown in Figure 12-3. Sections of this document are referenced under each heading, as appropriate, for specific details on each parameter.

As stated previously, Figures 12-1, 12-2, and 12-3 may be reformatted by LLNL (e.g., for computer-generated forms). However, all parameters noted on the forms must be included in the modified versions.

TRUPACT-II Outer Containment Assembly (OCA) Body No.: The identification number on the TRUPACT-II OCA body is recorded on the PATCD.

Shipment No.: The Transportation Certification Official records the shipment number on the PATCD. The shipment number will be provided by WIPP or can be assigned by LLNL for shipments to other storage sites.

TRUPACT-II OCA Lid No.: The identification number on the TRUPACT-II OCA lid is recorded.

Payload Shipping Category: The Transportation Certification Official records the shipping category of the payload to be shipped. All of the payload containers within a TRUPACT-II must be of the same shipping category, and analytically qualified containers cannot be shipped with containers qualified by test. The Transportation Certification Official ensures this by visually inspecting the affixed shipping category labels on each payload container or on the respective PCTCDs.

Decay Heat Limit for Shipping Category: When the payload shipping category is assigned, the allowable decay heat limit for the TRUPACT-II payload, as defined in Table 9-1, is recorded.

Payload Container Configuration: The Transportation Certification Official identifies and records the type of payload containers being assembled in the TRUPACT-II (refer to Section 7.1).

Payload Composition: The Transportation Certification Official records the following parameters on the PATCD from individual PCTCDs:

- Payload Container I.D. Number
- Weight and error
- FGE and two times the error
- Decay heat and error.

The weights, FGEs, and decay heats of individual containers are summed, and the total error for each parameter shall be calculated by utilizing the square root of the sum of the squares of the individual errors (indicated in Figures 12-1 and 12-2). The error on the total weight can also be estimated by weighing the total payload assembly and determining the error.

Total Fissile Quantity (With Error) of All Containers: The Transportation Certification Official verifies that the total fissile quantity + the error for all the

containers comprising a shipment is recorded and is complete. The resulting total shall not exceed the limits for fissile quantity for a TRUPACT-II, as stated in Section 8.1.

Total Decay Heat (With Error) of All Containers: The Transportation Certification Official verifies that the total decay heat + error for all the containers comprising a shipment is recorded and is complete. The resulting total shall not exceed the limits set forth in Table 9-1 for the shipping category.

Total Weight (With Error) of Payload and Package: The Transportation Certification Official is responsible for ensuring that the total weight of the payload and package does not exceed those limits set in Section 10.1. The total error is determined by weighing the entire payload assembly. The top seven drums or SWB shall be verified to weigh no more than the bottom seven drums or SWB. The Transportation Certification Official shall ensure proper payload assembly to meet this requirement.

Maximum Dose Rate on the Outside of Package: The Transportation Certification Official is responsible for verifying that the dose rates measured for the package do not exceed those limits set forth in Section 11.1. The measured dose rates are recorded on the PATCD.

Date of ICV Closure: The Transportation Certification Official verifies the date that the ICV is closed on the PATCD.

Approved for Shipment: The Transportation Certification Official shall approve the shipment after verifying that all of the applicable limits are met.

Signatures: The Waste Certification Official and the Transportation Certification Official sign and date the PATCD upon assuring that the transportation requirements for the TRUPACT-II are met and that the payload is qualified for transport.

Once a complete payload (14 drums or 2 SWBs) is qualified for transportation, the physical assembly of the payload for loading into the TRUPACT-II should be performed pursuant to *HWM Procedure No. 204, "TRU Waste Shipment."*

12.3 Dunnage

Dunnage is not required in TRUPACT-II shipments when the 14-drum or 2-SWB configuration is used. However, dunnage must be used to complete one of the above configurations if fewer payload containers are available per shipment that meet all payload container and transportation requirements. An empty 55-gallon

drum or SWB may be used as dunnage. Dunnage drums may be assembled into a seven-pack of only dunnage drums, or they may be assembled into a seven-pack with drums of waste that meet all applicable requirements. In the latter case, the dunnage drum(s) are labeled with a unique package identification number like the waste drums. All dunnage containers are labeled "EMPTY" or "DUNNAGE." Shoring, including empty drums, is provided as necessary inside a TDOP.

13. Quality Assurance

All activities at LLNL are governed by a documented quality assurance program that complies with DOE Order 5700.6C, "Quality Assurance" (DOE 1991). This Order has been codified for nuclear facilities as 10 CFR 830.120. The "Quality Assurance Program" (LLNL 1994c) governs the quality assurance activities for all of LLNL. The quality policy of LLNL, as outlined in the Quality Management Program, is as follows:

> "All research, development, and operational activities will be conducted in accordance with our customers' needs and expectations, and with a commitment to excellence and continuous quality improvement."

The "Lawrence Livermore National Laboratory Transuranic Waste Program Certification and Quality Assurance Plan" (LLNL 1994a) is specifically applicable to quality assurance activities related to TRU waste certification at LLNL. This document describes how CH-TRU waste from LLNL is certified for shipment. The following subsections describe specific areas of the LLNL Quality Assurance Program applicable to CH-TRU waste shipments in the TRUPACT-II.

13.1 Responsibilities

The responsibilities for TRU waste management at LLNL are distributed within the various departments and divisions at LLNL. The "Lawrence Livermore National Laboratory Transuranic Waste Program Certification and Quality Assurance Plan" outlines the responsibilities of each of the departments involved in the generation and management of TRU waste.

TRU waste management at LLNL consists of two phases: waste generation and waste management. The facilities generating TRU waste do so as a result of their everyday operations and clean-up activities. As part of the generation function, this process also includes some verification and packaging activities. Once the waste is generated and packaged, the waste management portion of the LLNL organization takes responsibility and control of the waste. LLNL's waste management personnel (specifically, the HWM Division) are responsible for ensuring that all waste is properly stored and properly certified and shipped for disposal.

On the waste generation side, the Laboratory Director (or Deputy Directors in his absence) has assigned responsibility for the two waste generating facilities (i.e., the Plutonium Facility and the Heavy Element Facility) to Associate Directors. The Associate Director for Defense & Nuclear Technologies is responsible for the Plutonium Facility (Building 332) and in turn delegates responsibility for facility operation to the Superblock Manager and the Facility Manager. The Associate Director for Physics & Space Technology is responsible for the Heavy Element

Facility (Building 251) and in turn delegates responsibility for facility operations to the Facility Manager. Each Facility Manager's organization includes waste generators, waste parcel verifiers, and HWM Field Technicians (assigned from the HWM Division).

On the waste management side of the LLNL organization, the Laboratory Director (or Deputy Director) has assigned responsibility for overall waste management to the Associate Director for Plant Operations. The Associate Director for Plant Operations is responsible for various functions, including the Environmental Protection Department and the Quality Assurance Office. The HWM Division and the Waste Certification Program report to the Environmental Protection Department.

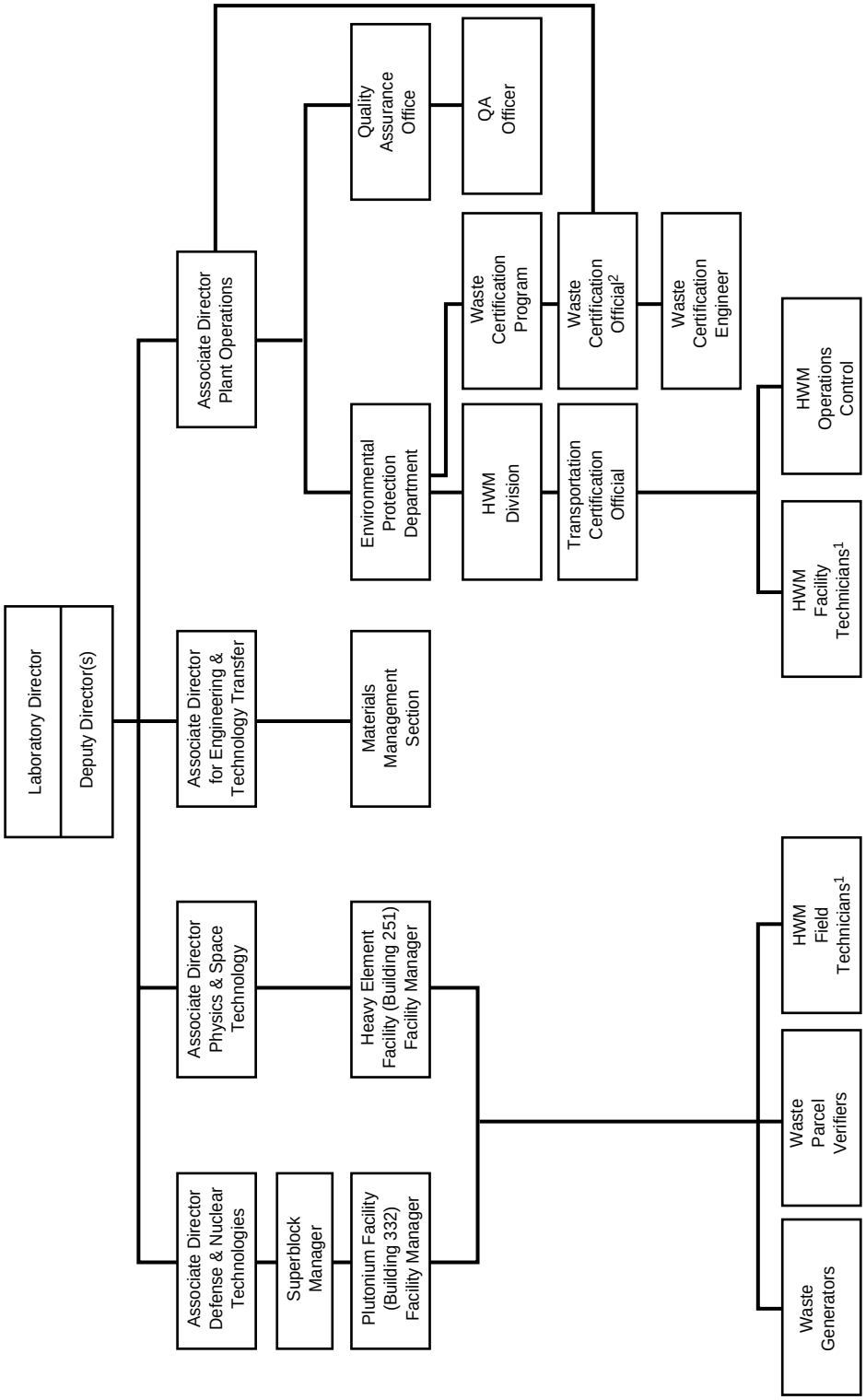
Figure 13-1 is an organization chart for LLNL that specifically details the waste generation and waste management functions at LLNL. This figure does not show the complete organization of LLNL and is intended to show only those organizations responsible for waste generation and waste management. The following subsections discuss the responsibilities of the various individuals involved in the TRU waste management process, separated into waste generation and waste management activities.

13.1.1 Waste Generation

13.1.1.1 Facility Manager

As described in Section 2.1.3, the majority of TRU waste at LLNL originates from two facilities (the Plutonium Facility and the Heavy Element Facility). Each facility is run by a Facility Manager. In addition to having oversight authority for all operations in its facility, each Facility Manager or designee has the following responsibilities associated with TRU waste certification:

- Approving facility-specific waste generating, packaging, and processing procedures
- Establishing training and qualification requirements with respect to the "Lawrence Livermore National Laboratory Transuranic Waste Program Certification and Quality Assurance Plan" (LLNL 1994a)
- Monitoring and documenting waste packaging activities to assure that responsible procedures are implemented
- Assuring that waste packages comply with certification requirements as set forth in the "Lawrence Livermore National Laboratory Transuranic Waste Program Certification and Quality Assurance Plan"



[1] HWM Field Technicians report to the HWM Division, but are assigned to other facilities.
[2] The Waste Certification Official reports to the Associate Director–Plant Operations when performing waste certification activities.

Figure 13-1 Organization Chart for LLNL TRU Waste Certfication Program

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- Assuring that TRU waste drums and boxes (empty or filled) are not left in the weather unprotected in order to preclude water intrusion into the containers
- Reporting any nonconformance and taking action to correct problems pertaining to TRU waste packaging activities
- Maintaining current information in the Facility Safety Procedure pertaining to TRU waste.

13.1.1.2 Waste Generators

The various waste generators and their line managers have the following responsibilities:

- Complying with administrative personnel controls designed to ensure only qualified personnel perform necessary tasks
- Inspecting containers before filling (this may also be performed by another trained, designated person) as per procedures outlined in *Appendix H of the Building 332 FSP* and in *Procedure TIP-HEF-008*
- Packaging TRU waste pursuant to facility procedures (*Appendix H of the Building 332 FSP* and *Procedure TIP-HEF-008*)
- Certifying compliance with the TRU waste form acceptance criteria
- Documenting waste generation, packaging, and processing on the data collection forms
- Implementing actions necessary to correct any nonconformance that is identified.

13.1.1.3 Waste Parcel Verifier

A waste parcel verifier is an individual, other than the person generating the waste, who is trained under the facility TRU waste training program and is approved as a verifier by the Facility Manager. The Facility Manager maintains a list of approved verifiers. Verification activities involve the following:

- Physically examining waste before waste parcel packaging or destructive examination of waste parcels
- Surveying of waste parcel packaging
- Checking and completing the LLNL TRU Waste Parcel Card.

All three verification activities are performed during each verification. Every waste parcel must be verified.

The waste parcel verifier fills out the verification section of the LLNL TRU Waste Parcel Card and signs it for those waste parcels that have been verified.

13.1.1.4 HWM Field and Facility Technicians

HWM Field Technicians assigned to Buildings 332 and 251 have the following responsibilities in regard to TRU waste certification:

- Supplying empty waste containers and data collection forms for waste generators and, if designated by the waste generator, inspecting waste containers before use
- Visually checking the external condition of filled TRU waste containers before they are moved to an HWM storage facility, according to *HWM Procedure No. 202*
- Serving as liaison among the waste generators, the HWM Division, and the Waste Certification Program.

At the Building 612 Area, designated HWM Facility Technicians have the following additional responsibilities in regard to TRU waste certification:

- Inspecting and distributing new empty waste containers and filled containers according to *HWM Procedure No. 202*
- Working with the HWM Operations Control Office to maintain a file of TRU waste data packages for each waste container.

13.1.2 Waste Management

13.1.2.1 Associate Director for Plant Operations

The LLNL Deputy Director delegates to the Associate Director for Plant Operations, upon the recommendation by the Waste Certification Official or Quality Assurance Officer, the authority to stop operations that are producing TRU waste that cannot be certified for shipment to the WIPP or another treatment, storage, or disposal facility.

13.1.2.2 Quality Assurance Officer

The Quality Assurance Officer has responsibility for management of the TRU waste Quality Assurance Program and works with the Waste Certification Official to effect quality control of the TRU Waste Program. Specific responsibilities of the Quality Assurance Officer are as follows:

- Reviewing TRU waste policies and procedures
- Performing audits
- Verifying that corrective actions are performed in relation to audit findings.

13.1.2.3 Transportation Certification Official

The Transportation Certification Official is responsible for approving all shipments of CH-TRU waste, thereby documenting that all transportation parameters have been met and the shipment is approved for transport. Specific responsibilities of the Transportation Certification Official include reviewing all payload data sheets and documenting compliance with the transportation parameters described in this document; ensuring that the proper shipping category, TRUCON code, and LLNL waste form number are assigned to each container and shipment; and approving waste containers and payload assemblies for shipment by signing the PCTCD and the PATCD, thus authorizing shipment of authorized payloads.

The Transportation Certification Official works closely with the Waste Certification Official to ensure that all waste containers and shipments are certifiable for transport and that all documentation packages are complete and accurate.

13.1.2.4 Waste Certification Official

The Waste Certification Official has the responsibility for management of the Certification Program and works closely with the Quality Assurance Officer to effect quality control of the TRU waste program. Specific responsibilities of the Waste Certification Official with regard to the Certification Program are as follows:

- Preparing, issuing, controlling, and maintaining the "Lawrence Livermore National Laboratory Transuranic Waste Certification and Quality Assurance Plan" and the LLNL Application to ship waste to the NTS or other interim treatment, storage, or disposal site

- Assigning and directing the Waste Certification Engineer(s) for TRU waste certification activities and ensuring that they are properly trained to carry out all aspects of certifying waste to applicable WAC

- Establishing requirements for certification procedures and ensuring all activities of the Certification Program are implemented

- In conjunction with the Transportation Certification Official, certifying that TRU waste packages comply with the WAC of the treatment, storage, or disposal facility where the waste is to be shipped by signing the Certification Statement

- In conjunction with the Transportation Certification Official, certifying that each TRU waste shipment meets applicable requirements of the treatment, storage, or disposal facility where the waste is to be shipped

- Resolving conflicts between different divisions or facilities

- Assuring, with the assistance of the Waste Certification Engineer, that nonconformances are reported, corrected, and archived

- Requesting audits of the TRU Waste Program by the TRU Waste Quality Assurance Officer and assuring completion of the audits through approval of corrective actions and receipt of completed Corrective Action Forms.

The Waste Certification Official has final authority for the Certification Program. Therefore, he/she reviews and signs off on all certification-related documents and procedures. This responsibility may be delegated to a qualified individual.

13.1.2.5 Waste Certification Engineer

The Waste Certification Engineer is a member of the Waste Certification Program in the Environmental Protection Department and reports to the Waste Certification Official. In support of the Certification Program, the Waste Certification Engineer has the following responsibilities:

- Writing, revising, and updating the "Lawrence Livermore National Laboratory Transuranic Waste Program Certification and Quality Assurance Plan"

- Reviewing HMPTS container procurement control and associated quality assurance programs

- Coordinating certification activities

- Providing liaison and internal consulting assistance

- Certifying that generated TRU waste is properly segregated, packaged, and meets the requirements of the treatment, storage, or disposal facility WAC, which is complete when the Waste Certification Engineer signs the LLNL TRU Waste Disposal Requisition

- Reviewing the documentation package for each waste container for completeness and accuracy

- Verifying that data generated as part of certification are in compliance with requirements

- Maintaining a list of authorized waste parcel verifiers and checking proper verification on the LLNL TRU Waste Parcel Cards

- Instructing the EP 0021 course for waste generators and waste parcel verifiers.

13.1.2.6 HWM Operations Control Office

The HWM Operations Control Office maintains a file for each TRU waste container that contains a copy of the five data collection forms, the inspection checklist, and the certification statement and sends copies, as specified in *Procedure WCP-4*, to the Waste Certification Program for dual storage. The HWM Operations Control Office is also responsible for generating all documents associated with shipments and for assigning containers to a shipment.

13.2 Audits and Surveillances

The Quality Assurance Officer, working with the Waste Certification Official, establishes, schedules, and manages the Quality Assurance audit system. *Procedure WCP-1, "Audits,"* describes the controls necessary to establish and implement the formal audit program for LLNL's Waste Certification Program activities. The audits described in this procedure are internal to LLNL and external to the Waste Certification Program, thereby maintaining the independence of the audit function. This procedure also outlines the minimum number of audits that are planned in consultation with the Waste Certification Official.

Surveillances of certification activities are performed by the TRU Waste Certification Program on a regularly scheduled basis. *Procedure WCP-7, "Quality Surveillances,"* prescribes the performance of quality surveillances that will enhance the assurance that activities pertaining to low-level and TRU waste operations such as packaging, handling, and shipping of radioactive waste are conducted safely and in accordance with approved procedures.

13.3 Nonconformances

Procedure WCP-3 provides LLNL personnel with the approved methods for reporting and correcting nonconforming conditions affecting low-level and TRU waste certification. As discussed in earlier chapters, NCARs are generated as needed for noncompliant waste containers, which are segregated for corrective action.

13.4 Corrective Actions

The Waste Certification Official institutes corrective actions to address issues identified in audits, surveillances, verifications, appraisals, and trends in nonconformances as specified in *Procedures WCP-2 and WCP-3*, which provide LLNL personnel with the approved methods for reporting, documenting, and

implementing corrective actions. It is the responsibility of the waste generator to bring the waste into conformance and to correct nonconformances.

13.5 Training

The American Society of Mechanical Engineers (ASME) standard NQA-1 requires indoctrination and training of personnel performing activities affecting quality (ASME 1989). This training program ensures that the requirements listed in Appendix 1.3.7 of the TRUPACT-II SARP, as well as any other applicable training requirements contained in NQA-1, are met. All personnel involved in TRU waste generating, packaging, handling, verifying, inspecting containers, and overseeing functions must complete the TRU Waste Training Program for their assigned facility. Training includes familiarization with the WIPP WAC documentation and the specific requirements of the "Lawrence Livermore National Laboratory Transuranic Waste Certification and Quality Assurance Plan" and this document.

Waste generators must complete two training courses—TRU Waste Certification Program (EP 0021) and Hazardous Waste Handling Practices (EP 0006). In addition, personnel operating assay equipment must be trained in its use and must be currently authorized to use it by the organization responsible for the assay equipment. Personnel applying or removing TIDs to or from waste packages or operating equipment used to assay waste packages to which TIDs have been applied shall have completed MM Section TID training and must be authorized TID users. Other specific training is conducted for personnel involved in support functions of the TRU Waste Certification Program, such as shipping and radiation surveys.

In addition to the above training courses, personnel responsible for using the TRUPACT-II Mobile Loading Unit (MLU) are trained in its use. LLNL site-specific TRUPACT-II operating procedures in *HWM Procedure No. 204* provide instructions on setting up the MLU, loading the trailer, loading the TRUPACT-II, performing the required leak tests, unloading the empty TRUPACT-II from the trailer, loading the TRUPACT-II trailer at remote sites, preparing an empty TRUPACT-II for shipment, operating the elevating work platform, and operating the adjustable center-of-gravity lift fixtures. Also required within the TRU Waste Management Program is training on the tracking software for TRUPACT-II shipments (the Transportation Tracking and Communications [TRANSCOM] system). The Transportation Certification Official or designee will be responsible for this function. LLNL personnel trained in the use of TRANSCOM will conduct the necessary shipment tracking for all CH-TRU waste shipments from LLNL. The use of TRANSCOM for all TRUPACT-II shipments satisfies the requirements in DOE Order No. 5820.2A for using a real-time tracking communication system for CH-TRU waste shipments (DOE, 1988). The use of the TRUPACT-II as outlined in this document also satisfies the requirements in DOE Order 5820.2A of transporting all TRU waste in certified Type B packaging and of the use of a DOE-controlled carrier system for TRU waste shipments by truck (DOE, 1988).

Table 13-1 presents an overview of the training provided for the LLNL staff involved in the TRU Waste Certification Program as it applies to shipments with the TRUPACT-II.

Table 13-1. Summary of Training Requirements for TRUPACT-II Use

Job Title	Certification / Training Required	Comments
Facility Manager	HS0050	Establishes training and qualification requirements
Waste Generators	EP 0021 EP 0006	Every two years Every year
Waste Certification Official	EP 0021 EP 0006	Every two years Every year
Transportation Certification Official	EP 0021 EP 0006	Every two years Every year
Quality Assurance Officer	EP 0021 EP 0006	Every two years Every year
Waste Certification Engineer	EP 0006 EP 0055-202	Every year Every two years Instructs the EP 0021 course
Waste Parcel Verifier	EP 0021	Every two years
Hazardous Waste Management TRU Technician	EP 0006 EP 0021 EP5120-015 EP5120-021	Every year Every two years Receive on-the-job training for TRU waste storage in HWM facilities

Table 13-1. Summary of Training Requirements for TRUPACT-II Use (continued)

Job Title	Certification / Training Required	Comments
Building 332 Technicians performing waste solidification processes	EP 0021 EP 0006 HS 6010 HS 6600	Every two years Every year Every two years Every two years Be approved by Operations Manager Be qualified Radiation Zone I worker Receive on-the-job training from a Plutonium Handler certified for work station 7805
SGS Operator	MM0705	Must be an authorized SGS user and an authorized TID user Must be certified as a Radiation Zone Worker I
SGS Calibration Personnel	HS6010 HS6600 MM0702	Must be authorized calibration personnel

Table 13-1. Summary of Training Requirements for TRUPACT-II Use (continued)

Job Title	Certification / Training Required	Comments
Waste Drum Assayer	MM TID training course	Must be authorized TID user
Leak Tester		Must be certified as Level II to sign off on shipments. Level I can be supervised by Level II.

14. Summary

This LLNL TRAMPAC document describes payload control at LLNL to ensure that all shipments of CH-TRU waste in the TRUPACT-II meet the requirements of the TRUPACT-II SARP. This document also provides specific instructions for the selection of authorized payloads once individual payload containers are qualified for transport. The physical assembly of the qualified payload and operating procedures for the use of the TRUPACT-II, including loading and unloading operations, are described in *HWM Procedure No. 204,* based on the information in the TRUPACT-II SARP. The LLNL TRAMPAC, along with the TRUPACT-II operating procedures contained in *HWM Procedure No. 204,* meet the documentation needs for the use of the TRUPACT-II at LLNL.

Table 14-1 provides a summary of the LLNL waste generation and certification procedures as they relate to TRUPACT-II payload compliance.

Table 14-1 Summary of LLNL Waste Generation and Certification Procedures

TRUPACT-II Payload Compliance Parameter	LLNL TRAMPAC Chapter	Applicable LLNL Procedures and Documents	
		Document No.	Title
Payload classification	2	M-078-121	LLNL Transuranic Waste Program Certification and Quality Assurance Plan
		WCP-20 (draft)	Management of TRU Waste by TRU Waste Generators
		WCP-21 (draft)	Certification of Transuranic Waste Packages
		HWM 202	TRU Container Inspection and Control
		Appendix H of Building 332 FSP	Transuranic Waste Handling and Packaging Procedures
		TIP-HEF-008	Waste Acceptance Criteria (WAC) Procedures
		TIP-HEF-009	TRU Waste Container Inspection Procedure
		TIP-HEF-011	DOT 17-C or UN 1A2 Drum Closure Procedure
		LL 5584A	LLNL TRU Waste Container Inspection Card
		LL 5584B	LLNL TRU Waste Container Final Inspection Card
		LL 5586	LLNL TRU Waste Parcel Card
		LL 5587A	LLNL TRU Waste Disposal Requisition
		UCRL-CR-116692	LLNL TRAMPAC

Table 14-1 Summary of LLNL Waste Generation and Certification Procedures (continued)

TRUPACT-II Payload Compliance Parameter	LLNL TRAMPAC Chapter	Applicable LLNL Procedures and Documents	
		Document No.	Title
Physical form	3	M-078-121	LLNL Transuranic Waste Program Certification and Quality Assurance Plan
		UCRL-AR-119486	LLNL TRU Waste Characterization Quality Assurance Project Plan
		WCP-20 (draft)	Management of TRU Waste by TRU Waste Generators
		WCP-21 (draft)	Certification of Transuranic Waste Packages
		Appendix H of Building 332 FSP	Transuranic Waste Handling and Packaging Procedures
		MM-V-41	TRU Waste Solidification in Building 332
		TIP-HEF-007	Liquid Waste Solidification Procedure
		TIP-HEF-008	Waste Acceptance Criteria (WAC) Procedures
		LL 5586	LLNL TRU Waste Parcel Card
Chemical form and chemical properties	4	M-078-121	LLNL Transuranic Waste Program Certification and Quality Assurance Plan
		UCRL-AR-119486	LLNL TRU Waste Characterization Quality Assurance Project Plan

Table 14-1 Summary of LLNL Waste Generation and Certification Procedures (continued)

TRUPACT-II Payload Compliance Parameter	LLNL TRAMPAC Chapter	Applicable LLNL Procedures and Documents	
		Document No.	Title
Chemical form and chemical properties (continued)	4	Appendix H of Building 332 FSP	Transuranic Waste Handling and Packaging Procedures
		TIP-HEF-008	Waste Acceptance Criteria (WAC) Procedures
		LL 5586	LLNL TRU Waste Parcel Card
Chemical compatibility	5		TRUPACT-II SARP Compatibility Study
Gas distribution and pressure buildup	6		Controls on chemical properties, payload container and contents configuration, and decay heat
Payload container and contents configuration	7	WCP-4 (draft)	Records Control
		HWM 201	Standard Operating Procedure
		HWM 202	TRU Container Inspection and Control
		Appendix H of Building 332 FSP	Transuranic Waste Handling and Packaging Procedures
		TIP-HEF-009	TRU Waste Container Inspection Procedure
		LL 5584A	LLNL TRU Waste Container Inspection Card
		LL 5584B	LLNL TRU Waste Container Final Inspection Card

Table 14-1 Summary of LLNL Waste Generation and Certification Procedures (continued)

TRUPACT-II Payload Compliance Parameter	LLNL TRAMPAC Chapter	Applicable LLNL Procedures and Documents	
		Document No.	Title
Isotopic inventory and fissile content	8	MM-V-06	Segmented Gamma Scanner Operation
		MM-V-14	Segmented Gamma Scanner Calibration
		TIP-HEF-010	Gamma Ray Spectrometry of Waste Parcels Procedures
		LL 5586	LLNL TRU Waste Parcel Card
		LL 5587A	LLNL TRU Waste Disposal Requisition
Decay heat	9	MM-V-06	Segmented Gamma Scanner Operation
		MM-V-14	Segmented Gamma Scanner Calibration
		LL 5587A	LLNL TRU Waste Disposal Requisition
		UCRL-CR-116692	LLNL TRAMPAC
Weight and center of gravity	10	WCP-3	Nonconformance Reporting
		HWM 203	TRU Waste Shipment Preparation Procedure
		LL 5585	LLNL TRU Waste Radiological Survey Card
		UCRL-CR-116692	LLNL TRAMPAC

Table 14-1 Summary of LLNL Waste Generation and Certification Procedures (continued)

TRUPACT-II Payload Compliance Parameter	LLNL TRAMPAC Chapter	Applicable LLNL Procedures and Documents	
		Document No.	Title
Radiation dose rate	11	WCP-2 (draft)	Corrective Action
		WCP-3	Nonconformance Reporting
		HWM 203	TRU Waste Shipment Preparation Procedure
		LL 5585	LLNL TRU Waste Radiological Survey Card
		UCRL-CR-116692	LLNL TRAMPAC
Payload assembly criteria	12	HWM 204	TRU Waste Shipment
		UCRL-CR-116692	LLNL TRAMPAC
Quality assurance	13	M-078-121	LLNL Transuranic Waste Program Certification and Quality Assurance Plan
		M-078	Quality Management Program
		WCP-1 (draft)	Audits
		WCP-2 (draft)	Corrective Actions
		WCP-3	Nonconformance Reporting
		WCP-4 (draft)	Records Control
		WCP-7 (draft)	Quality Surveillances
		HWM 202	TRU Container Inspection and Control

Table 14-1 Summary of LLNL Waste Generation and Certification Procedures (continued)

TRUPACT-II Payload Compliance Parameter	LLNL TRAMPAC Chapter	Applicable LLNL Procedures and Documents	
		Document No.	Title
Quality assurance (continued)	13	HWM 204	TRU Waste Shipment
		Appendix H of Building 332 FSP	Transuranic Waste Handling and Packaging Procedures
		TIP-HEF-008	Waste Acceptance Criteria (WAC) Procedures

15. References

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Department of Energy (1988), *Radioactive Waste Management*, U.S. Department of Energy, Washington, DC, DOE Order 5820.2A, September 26, 1988.

Department of Energy (1991), *Quality Assurance*, U.S. Department of Energy, Washington, DC, DOE Order 5700.6C, August 21, 1991.

Department of Energy (1992) *TRUPACT-II Content Codes (TRUCON)*, Rev. 6, U.S. Department of Energy, Carlsbad, NM, DOE/WIPP 89-004, September 1992, or latest approved revision.

Hatayama, H. K., J. J. Chen, E. R. de Vera, R. D. Stephens, D. L. Storm (1980), *A Method for Determining the Compatibility of Hazardous Wastes*, U.S. Environmental Protection Agency, Cincinnati, OH, EPA-600/2-80-076, April 1980.

Lawrence Livermore National Laboratory (1994a), *Lawrence Livermore National Laboratory Transuranic Waste Program Certification and Quality Assurance Plan*, Lawrence Livermore National Laboratory, Livermore, CA, M-078-121, Rev. 2, May 1994.

Lawrence Livermore National Laboratory (1994b), *Lawrence Livermore National Laboratory TRU Waste Characterization Quality Assurance Project Plan*, Lawrence Livermore National Laboratory, Livermore, CA, Draft, July 13, 1994.

Lawrence Livermore National Laboratory (1994c), *Quality Assurance Program*, Lawrence Livermore National Laboratory, Livermore, CA, M-078, Rev. 2, July 1994.

Nuclear Regulatory Commission (1994), *Certificate of Compliance for Radioactive Materials Package*, Rev. 5, U.S. Nuclear Regulatory Commission, Washington, DC, Docket No. 71-9218, June 9, 1994.

NuPac (1992), *Safety Analysis Report for the TRUPACT-II Shipping Package*, Rev. 12, Nuclear Packaging Inc., Federal Way, WA, September 1992, or latest approved revision.

16. Glossary

CONTACT-HANDLED TRU WASTE: Transuranic waste materials that are packaged in such a way that the dose rate at the surface of the waste package is not greater than 200 mrem/hour.

DECAY HEAT: Heat produced by radioactive emissions that are absorbed in the surrounding materials.

DEFICIENCY: A departure from specified requirements that may be remedied by completion or correction.

DOCUMENTATION PACKAGE: Files that contain required paperwork that describes or characterizes each waste container. The following are required in a TRU waste documentation package from the waste generator:

- LLNL TRU Waste Container Inspection Card
- LLNL TRU Waste Disposal Requisition
- LLNL TRU Waste Parcel Card

The following are added after receipt for storage by the HWM Division:

- LLNL TRU Waste Container Final Inspection Card
- LLNL TRU Waste Container Radiological Survey Card.

FREE LIQUID: Liquid that is not sorbed on or in a host material such that it could spill or drain from its container.

G VALUE: The number of molecules of gas species produced per 100 electron volts of decay energy absorbed by the waste.

GENERATOR: Any person or organization whose act or process produces a waste or whose act causes a waste to become subject to regulation or DOE order.

LAYER OF CONFINEMENT: Any plastic bag containing transuranic waste material that is closed by a twist-and-tape or fold-and-tape method. Punctured bags or liners, bags open at the end, or pieces of plastic sheet wrapped around the waste for handling are not considered as layers of confinement.

LLNL CERTIFICATION PROGRAM: The program at LLNL, governed by the "Lawrence Livermore National Laboratory Transuranic Waste Program Certification and Quality Assurance Plan," which assures that the waste generated at LLNL is certifiable for shipment to a treatment, storage, or disposal facility.

LLNL TRU WASTE PARCEL CARD: A waste certification form used at LLNL to determine the certifiability of a final waste package. This card documents waste parcel contents and is completed for every parcel of TRU waste generated at LLNL.

LLNL TRU WASTE CONTAINER INSPECTION CARD: A waste certification form used at LLNL to document visual inspection of empty waste containers procured from the vendors prior to placement of waste in a container. This card is completed both by the HWM Division (which procures the containers) and the Waste Generators (who use the containers for packaging waste).

LLNL TRU WASTE CONTAINER FINAL INSPECTION CARD: A waste certification form used at LLNL to document visual examination of a waste container after the waste is placed inside by the Waste Generator. This examination is performed by the HWM Division.

LLNL TRU WASTE DISPOSAL REQUISITION: A waste certification form used at LLNL to determine the certifiability of a final waste container. Data from each of the Waste Parcel Cards are compiled and entered on this card, thereby documenting the complete contents of a waste container.

LLNL TRU WASTE RADIOLOGICAL SURVEY CARD: A waste certification form used at LLNL that contains information on the total weight, surface contamination, dose measurement, and instrument performance data for each waste package.

NEWLY GENERATED WASTE: Waste that was precertified or has been generated under a documented certification program and is awaiting shipment to an off-site storage or disposal site.

NONCONFORMANCE: A deficiency in characteristic, documentation, or procedure that renders TRU waste parcels and TRU waste packages noncertifiable. If a nonconformance can be corrected immediately, it does not require documentation by a Nonconformance and Corrective Action Report.

PAYLOAD CONTAINERS: For the TRUPACT-II, currently authorized payload containers are 55-gallon drums, standard waste boxes (SWBs), and ten-drum overpacks used to overpack ten 55-gallon drums or one SWB.

Pu-239 FISSILE GRAM EQUIVALENT (FGE): The amount of Pu-239 that would produce an equivalent K_{eff} as that determined for a fissile material in a container (assuming all containers are in an optimally moderated infinite array) is called the Pu-239 fissile gram equivalent. U-235 and U-233 and other isotopes shall be calculated as Pu-239 fissile equivalents using ANSI/American Nuclear Society Standard 8.15-1981.

RETRIEVABLY STORED WASTE: Waste that was not precertified or was generated prior to a documented certification program and is in storage.

SHIPPING CATEGORY: A waste classification system used to facilitate transportation of CH-TRU waste in the TRUPACT-II, based on the physical and chemical form of the waste and the waste packaging configuration.

TRAMPAC: TRUPACT-II Authorized Methods for Payload Control document developed to show how all waste parameters are controlled to assure TRUPACT-II payloads meet the TRUPACT-II shipping requirements and limits.

TRANSURANIC (TRU) WASTE. Radioactive waste containing alpha-emitting radionuclides having atomic numbers greater than 92 and half-lives greater than 20 years in concentrations greater than 100 nCi/g at the time of assay.

TRUCON CODE: A unit of waste classification defined in the TRUPACT-II Content Codes document (the TRUCON document) for transportation purposes. Wastes belonging to the same TRUCON code have similar physical and chemical characteristics.

WASTE CERTIFICATION: Activities associated with waste processing and records required to certify that a waste meets the applicable waste acceptance criteria.

WASTE PACKAGE: A TRU waste package consists of a TRU waste container and the TRU waste parcels inside the container.

WASTE PARCEL: Waste generated and packaged in confinement layers (plastic bags or metal cans) constitutes a waste parcel. One or more waste parcels are then placed into a waste container.

WASTE TYPE: Refers to the types of TRU waste, such as solidified inorganics (Waste Type I), solid inorganics (Waste Type II), solid organics (Waste Type III), and solidified organics (Waste Type IV).

Appendix A

The following pages contain current versions of the data forms critical to the waste certification process, including the following:

LLNL TRU Waste Parcel Card
LLNL TRU Waste Disposal Requisition
LLNL TRU Waste Container Inspection Card
LLNL TRU Waste Container Final Inspection Card
LLNL TRU Waste Radiological Survey Card
TRU Waste Package Certification Checklist

No. 00000

LLNL TRU WASTE PARCEL CARD

(Fill out using dark, indelible ink only)

Waste Packaging Date: _____ Card _____ of _____

Continued from: __ __ __ __ __

Bldg: _____ Room: _____ Workstation (if available): _____

Container Serial No.: LL85 __ __ __ __ __ __ TRU

LLNL WASTE FORM(S):

No. **1**	Glove Box Waste	❑ Yes ❑ No
No. 2	Solidified Liquid Waste:	
2a	Oils or solvents present	❑ Yes ❑ No
2b	Aqueous only	❑ Yes ❑ No
No. **3**	Metal Scrap Waste	❑ Yes ❑ No
No. 4	Waste Salt Blocks:	
4a	Trace organics present	❑ Yes ❑ No
4b	Organics absent	❑ Yes ❑ No
No. **5**	HEPA Filters	❑ Yes ❑ No

HAZARDOUS MATERIAL CHARACTERIZATION:

Hazardous Material(s)*: ❑ Yes ❑ No (list)

MATERIAL	AMOUNT	UNITS (g,l)†

*Mixed waste is to be deposited in a mixed waste container only.
†Units of volume are to be used for liquids only.

To be filled out by HWM Review Chemist:

EPA/CA Hazardous Waste Code	EPA/CA Hazardous Waste Form Code

HWM Review Chemist:

Initials _____ Date _____

RADIOACTIVITY CHARACTERIZATION:

Weapons Pu (Pu-240≤6% + Am-241≤1%)	❑ Yes ❑ No
Fuel Pu (6%<Pu-240≤12% + Am-241≤1%)	❑ Yes ❑ No
Reactor Pu (12%<Pu-240≤25% + Am-241≤1%)	❑ Yes ❑ No
Am-Enriched Pu (Pu-240≤15% + 1%<Am-241≤25%)	❑ Yes ❑ No
Mixed Pu (15%<Pu-240≤50% + 1%<Am-241≤25%)	❑ Yes ❑ No

(The percentages are fractions of total mass of radionuclides)

Other Radionuclide(s): ❑ Yes ❑ No (list)

NUCLIDE	AMOUNT	UNITS (g, Ci)

PARCEL PACKAGING:

Parcel has the following number of gas confinement layers, e.g., taped plastic bags:

❑ **2**

❑ ___

Physical Description and Inventory of Waste: _____

This parcel DOES NOT contain classified material, free liquids, fine particles (> 1% by weight of particles < 10 μm diameter or > 15% by weight of particles < 200 μm diameter), compressed gas, explosives, pyrophorics, or ignitable, corrosive, or reactive materials.

Generator: _____ (Printed Name) _____ (Signature) __ __ __ __ __ __ (Employee #)

VERIFICATION: (Every parcel must be verified.)

Visually inspect the waste to be packaged, the waste packaging operations, and each waste parcel, according to procedure and training to answer the following 3 questions:

1. Is the waste characterization and other information supplied by the waste generator on this form complete and accurate? ❑ Yes ❑ No
2. Does the waste parcel contain any of the following?

Classified Material	❑ Yes ❑ No	Compressed Gas	❑ Yes ❑ No	Ignitable Materials	❑ Yes ❑ No
Free Liquids	❑ Yes ❑ No	Explosives	❑ Yes ❑ No	Corrosive Materials	❑ Yes ❑ No
Fine Particles	❑ Yes ❑ No	Pyrophorics	❑ Yes ❑ No	Reactive Materials	❑ Yes ❑ No

3. Are there any RCRA or CA hazardous materials in this waste parcel? ❑ Yes ❑ No

Verifier: _____ (Printed Name) _____ (Signature) __ __ __ __ __ __ (Employee #) _____ (Date Verifier Authorization Expires) Verification Date: _____

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TRU WASTE CERTIFICATION ENGINEER REVIEW AND APPROVAL: _____ (Initials) _____ (Date)

LLNL TRU WASTE DISPOSAL REQUISITION

(Fill out using dark, indelible ink only)

Card _______ of _______

— GENERATOR / COMPILER SECTION —

Container Serial No.: LL85 __ __ __ __ __ __ TRU

Bldg. ____________ Room ____________ Pick up at WAA No. ❑ **332A** ❑ **251** ❑ ________

Container Type (check one): ❑ 55 gal. drum ❑ TRUPACT-II Standard Waste Box (SWB)

Directorate: ❑ DNT (Defense & Nuclear Technologies, B. 332) ❑ PST (Physics & Space Technology, B. 251) ❑ __ __ __ (Other)

Workplace end date for waste package: ________________

Generator who ordered the container closed:

Printed Name ______________ Signature ______________

Employee # __ __ __ __ __ __

Requisition compiled by:

Printed Name ______________ Signature ______________

Employee # __ __ __ __ __ __

Compiled from LLNL TRU Waste Parcel Card Nos.

❑	❑	❑	❑
❑	❑	❑	❑
❑	❑	❑	❑
❑	❑	❑	❑
❑	❑	❑	❑
❑	❑	❑	❑
❑	❑	❑	❑
❑	❑	❑	❑
❑	❑	❑	❑
❑	❑	❑	❑

All LLNL TRU Waste Parcel Cards enclosed: ❑ Yes ❑ No

LLNL TRU Waste Container Inspection Card enclosed: ❑ Yes ❑ No

Waste Form(s) in this container:

No. **1**	Glove Box Waste	❑ Yes	❑ No
No. 2	Solidified Liquid Waste		
2a	Oils or solvents present	❑ Yes	❑ No
2b	Aqueous only	❑ Yes	❑ No
No. **3**	Metal Scrap Waste	❑ Yes	❑ No
No. 4	Waste Salt Blocks		
4a	Trace organics present	❑ Yes	❑ No
4b	Organics absent	❑ Yes	❑ No
No. **5**	HEPA Filters	❑ Yes	❑ No

LL 5587 A (Rev. 12/09/94)

RADIONUCLIDES

Check all Pu grades present

Weapons	❑ Yes	❑ No
Fuel	❑ Yes	❑ No
Reactor	❑ Yes	❑ No
Am - enriched	❑ Yes	❑ No
Mixed	❑ Yes	❑ No

Other Radionuclides ❑ Yes ❑ No (If yes, list:)

NUCLIDE	AMOUNT	UNITS (g, Ci)

Hazardous Materials ❑ Yes ❑ No (If yes, list:)

MATERIAL	AMOUNT	UNITS (g,l)*	EPA/CA Hazardous Waste Code

To be filled out by the HWM Review Chemist:

The contents of this container are compatible: ❑ Yes ❑ No

HWM Review Chemist's Initials ____________ Date ____________

*Units of volume are to be used for liquids only.

— CONTAINER CLOSURE AND SEALING —

Container Closed and Bolted by:

Printed Name ______________ Date ______________

Signature ______________ Employee # __ __ __ __ __ __

Container lid bolt(s) torqued to __________ ft-lbs.

Torque wrench identification no. ____________________

Calibration due date: ____________________

To be filled out by authorized Materials Management representatives:

Security Seal (TID) No(s). ____________________

Date Sealed: ______________ Sealed by:

1. Printed Name ______________ **2.** Printed Name ______________

Signature ______________ Signature ______________

Employee # __ __ __ __ __ __ Employee # __ __ __ __ __ __

This package contains accountable materials: ❑ Yes ❑ No

Printed Name ______________ Signature ______________

Employee # __ __ __ __ __ __

— Pu-239 γ ASSAY AT PLUTONIUM FACILITY—

To be completed for B-332 waste containers only:

Container Weight (lbs): ________

Date Assayed: ____________

Amt. of Pu-239 (g): ____________ ± (1σ) ____________

Authorized Materials Management Representative:

Printed Name ______________

Signature ______________

Employee # __ __ __ __ __ __

RADIOLOGICAL SURVEYS:

Dose (mrem/hr) at contact: β,γ: __________ N: __________

Swipe results (dpm/100cm^2): α: __________ β,γ: __________

Radiological Surveys Performed by:

Printed Name ______________ Date ______________

Signature ______________ Employee # __ __ __ __ __ __

TRU WASTE CERTIFICATION ENGINEER:

Activity: ______________ nCi/g

______________ PE-Ci

______________ α Ci

Thermal Power: __________ ± (1σ) __________ watt

Activity calculations by: Initials __________ Date __________

REVIEW AND APPROVAL: Initials __________ Date __________

HWM OPERATIONS:

Scheduled waste run date: __________

Container received at HWM by: Initials __________ Date __________

LLNL TRU WASTE CONTAINER INSPECTION CARD

(Fill out using dark, indelible ink only)
(Note abbreviations: Sat. = Satisfactory, Unsat. = Unsatisfactory)

CONTAINER SERIAL NO.: LL85 __ __ __ __ __ __ TRU **DATE:** _____

INSPECTED BY: _____ _____ ___ ___ ___ ___ ___ ___
Printed Name Signature Employee #

INSPECTED AT (check one): ❑ 1. HWM FACILITY ❑ 2. GENERATOR FACILITY

FOR DRUM OR BOX, VERIFY THAT THE CONTAINER HAS:

NO HOLES ❑ Sat. ❑ Unsat. NO SIGNIFICANT RUST ❑ Sat. ❑ Unsat. NO BAD SEAMS/WELDS ❑ Sat. ❑ Unsat.

NO OTHER DEFECTS ❑ Sat. ❑ Unsat.

FOR DRUMS ONLY, VERIFY THAT THE DRUM IS:

MARKED ❑ 55 GAL (Sat.) ❑ 208 L (Sat.) ❑ OTHER (Unsat.) MARKED ❑ "17C" (Sat.) ❑ "1A2" (Sat.) ❑ OTHER (Unsat.)

VERIFY THAT THE DRUM HAS:

A FILTER VENT ❑ Sat. ❑ Unsat. AN INTACT GASKET ❑ Sat. ❑ Unsat. A RIGID PLASTIC LINER ❑ Sat. ❑ Unsat.

A ≥ 0.3" VENT HOLE IN LINER LID ❑ Sat. ❑ Unsat. NO LINER DEFECTS ❑ Sat. ❑ Unsat.

AT GENERATOR FACILITY ONLY, A ≥ 0.0035" PLASTIC LINER BAG ❑ Sat. ❑ Unsat.

FOR BOXES ONLY, VERIFY THAT THE BOX:

IS A TRUPACT-II STANDARD WASTE BOX (SWB) ❑ Sat. ❑ Unsat. HAS TWO FILTER VENTS ❑ Sat. ❑ Unsat.

– – – – – – – – – –

REPORT DEFECTIVE CONTAINERS/LINERS TO TRU WASTE CERTIFICATION ENGINEER.

DESCRIBE ANY UNSATISFACTORY CONDITION IN COMMENTS, BELOW.

COMMENTS: _____

_____

_____

_____

❑ Check here if additional comments attached.

TRU WASTE CERTIFICATION ENGINEER REVIEW AND APPROVAL: _____ _____
Initials Date

LL 5584A (Rev. 12/09/94)

LLNL TRU WASTE CONTAINER **FINAL** INSPECTION CARD

(Fill out using dark, indelible ink only)
(Note abbreviations: Sat. = Satisfactory, Unsat. = Unsatisfactory)

CONTAINER SERIAL NO.: LL85 __ __ __ __ __ __ TRU **DATE:** _____

INSPECTED AT HWM BY: _____ _____ ___ ___ ___ ___ ___ ___
Printed Name Signature Employee #

FOR DRUM OR BOX, VERIFY THAT THE CONTAINER HAS:

NO HOLES ❑ Sat. ❑ Unsat. NO SIGNIFICANT RUST ❑ Sat. ❑ Unsat. NO BAD SEAMS/WELDS ❑ Sat. ❑ Unsat.

NO OTHER DEFECTS ❑ Sat. ❑ Unsat.

VERIFY THAT THE CONTAINER IS:

MARKED "USA DOT 7A TYPE A" ❑ Sat. ❑ Unsat.

FOR DRUMS ONLY, VERIFY THAT THE DRUM IS:

MARKED ❑ 55 GAL (Sat.) ❑ 208 L (Sat.) ❑ OTHER (Unsat.) MARKED ❑ "17C" (Sat.) ❑ "1A2" (Sat.) ❑ OTHER (Unsat.)

VERIFY THAT THE DRUM HAS:

A FILTER VENT ❑ Sat. ❑ Unsat.

FOR BOXES ONLY, VERIFY THAT THE BOX:

IS A TRUPACT-II STANDARD WASTE BOX (SWB) ❑ Sat. ❑ Unsat. HAS TWO FILTER VENTS ❑ Sat. ❑ Unsat.

REPORT DEFECTIVE CONTAINERS TO TRU WASTE CERTIFICATION ENGINEER
DESCRIBE ANY UNSATISFACTORY CONDITION IN COMMENTS, BELOW.

COMMENTS: _____

_____

_____

_____

❑ Check here if additional comments attached.

TRU WASTE CERTIFICATION ENGINEER REVIEW AND APPROVAL: _____ _____
Initials Date

LL 5584B (Rev. 12/09/94)

LLNL TRU WASTE RADIOLOGICAL SURVEY CARD

(Fill out using dark, indelible ink only)

CONTAINER SERIAL NO.: LL85 __ __ __ __ __ __ TRU

FILLED OUT AT: ❑ HWM, BEFORE STORAGE ❑ HWM, BEFORE SHIPPING

α – SURVEY INSTRUMENT: PERFORMANCE CHECK: ❑ SATISFACTORY ❑ NOT DONE

COMMENTS (if performance check is not done): _____

_____

MANUFACTURER: _____ MODEL NO.: _____

SERIAL NO.: _____ CALIBRATION DUE DATE: _____

β,γ – SURVEY INSTRUMENT: PERFORMANCE CHECK: ❑ SATISFACTORY ❑ NOT DONE

COMMENTS (if performance check is not done): _____

_____

MANUFACTURER: _____ MODEL NO.: _____

SERIAL NO.: _____ CALIBRATION DUE DATE: _____

NEUTRON SURVEY INSTRUMENT: PERFORMANCE CHECK: ❑ SATISFACTORY ❑ NOT DONE

COMMENTS (if performance check is not done): _____

_____

MANUFACTURER: _____ MODEL NO.: _____

SERIAL NO.: _____ CALIBRATION DUE DATE: _____

EXTERNAL DOSE (α: cpm; β,γ and NEUTRON: mrem/hr):

CONTACT: **α:** _____ **β,γ:** _____ **NEUT.:** _____ **TOTAL (β,γ,NEUT.):** _____

@ 1 METER: **β,γ:** _____ **NEUT.:** _____ **TOTAL (β,γ,NEUT.):** _____

DOSES MEASURED BY: _____ DATE: _____
Printed Name

_____ __ __ __ __ __ __
Signature Employee #

SWIPE COUNTER: PERFORMANCE CHECK: ❑ SATISFACTORY ❑ NOT DONE

COMMENTS (if performance check is not done): _____

_____

MANUFACTURER: _____ MODEL NO.: _____

SERIAL NO.: _____ DATE CALIBRATED: _____

SWIPE (dpm/100 cm²): **α:** _____ **β,γ:** _____

SWIPES PERFORMED BY: _____ DATE: _____
Printed Name

_____ __ __ __ __ __ __
Signature Employee #

BEFORE STORAGE AT HWM, WEIGH WASTE PACKAGE: GROSS WEIGHT: _____ **lbs.**

PACKAGE WEIGHED BY: _____ DATE: _____
Printed Name

_____ __ __ __ __ __ __
Signature Employee #

TRU WASTE CERTIFICATION ENGINEER REVIEW AND APPROVAL: _____ Initials _____ Date

LL 5585 (Rev. 10/22/93)

TRU WASTE PACKAGE CERTIFICATION CHECKLIST

CONTAINER DESCRIPTION:

Container Serial Number: LL85__ __ __ __ __ __ TRU

DOCUMENTATION SIGNOFF: *Initials*

1. Review and approval section of the LLNL TRU Waste Container Inspection Card has been initialed and dated _____
2. Review and approval sections of the LLNL TRU Waste Parcel Cards have been initialed and dated _____
3. Review and Approval section of the LLNL TRU Waste Disposal Requisition has been initialed and dated _____
4. Review and approval section of the LLNL TRU Waste Radiological Surevey Card has been initialed and dated _____
5. Review and Approval section of the LLNL TRU Waste Container Final Inspection Card has been initialed and dated _____

Checklist Complete, _____ _____
WCE Signature *Date*

(Rev. 01/31/95)

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